

<b>SOLICITATION, OFFER, AND AWARD</b> (Construction, Alteration, or Repair)	1. SOLICITATION NUMBER <b>DACA67-99-B-0024</b>	2. TYPE OF SOLICITATION <input checked="" type="checkbox"/> SEALED BID (B/F) <input type="checkbox"/> NEGOTIATED (B/F)	3. DATE ISSUED <b>2/19/99</b>	PAGE OF PAGES <b>1</b>
	<b>IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.</b>			
4. CONTRACT NUMBER <b>DACA67-99-C-0030</b>	5. REQUISITION/PURCHASE REQUEST NUMBER <b>W68MD9-8322-0877</b>	6. PROJECT NUMBER <b>PN: 083001</b>		
7. ISSUED BY <b>Seattle District, Corps of Engineers ATTN: CENWS-CT-CB PO Box 3755 Seattle, WA 98124-3755</b>	CODE <b>W68MD9</b>	8. ADDRESS OFFER TO <b>Seattle District, Corps of Engineers PO Box 3755 ATTN: CENWS-CT-CB Seattle, WA 98124-3755</b>  <b>HAND CARRY: Preston Conference Room 4735 East Marginal Way South Seattle, WA 98134-2385</b> <b>BID OPENING ROOM: Preston Conference Room</b>		
9. FOR INFORMATION CALL	A. NAME <b>See Information Page inside Front Cover</b>	B. TELEPHONE NUMBER (Include area code) (NO COLLECT CALLS) <b>See Information Page inside Front Cover</b>		

**SOLICITATION**

**NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".**

**10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, Identifying number, date):**

**Furnish all labor, materials and equipment and perform all work for USARC/OMS/MEP Phase 2, Fort Lawton, Washington in accordance with the attached Contract Clauses, Special Clauses, Technical Specifications and Drawings.**

1. Solicitation No. DACA67-99-B-0024 dated 19 Feb 99 with 6 amendments thereto.
2. Wage determination No. WA990002 with no modifications thereto.
3. Drawings as listed in Section 0800.

**NOTE: Award will be made pursuant to the Small Business Competitive Development Program.**

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>510</u> calendar days after receiving
<input checked="" type="checkbox"/> award, <input type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See <u>Paragraph SC-1</u> )
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.)
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
12B. CALENDAR DAYS <b>10</b>
13. ADDITIONAL SOLICITATION REQUIREMENTS:
A. Sealed offers in original and <u>0</u> copies to perform the work required are due at the place specified in Item 8 by <u>12:00 noon</u> (hour) local time <u>8 April 1999</u> (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
B. An offer guarantee <input checked="" type="checkbox"/> is, <input type="checkbox"/> is not required.
C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
D. Offers providing less than <u>90</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

## OFFER (Must be fully completed by offeror)

## 14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

Wick Constructors, Inc.  
720 N 35th Street  
P.O. Box 31509  
Seattle, WA 98103

Tax ID No: 91-1443991 DUNS No: 002824456

eMail: jacks@wickconst.com

## 15. TELEPHONE NUMBER (Include area code)

206-634-1550

FAX: 206-634-1565

## 16. REMITTANCE ADDRESS (Include only if different than item 14)

CODE

FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation. If this offer is accepted by the Government in writing within 90 calendar days after the date offers are due. (Insert any number equal or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in item 13D.)

AMOUNTS

See page 00010-4

18. The offeror agrees to furnish any required performance and payment bonds.

## 19. ACKNOWLEDGEMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.	0001	0002	0003	0004	0005	0006				
DATE	3/19/99	2/12/99	3/24/99	3/26/99	3/30/99	4/5/99				

## 20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

Christian T. Bratlien, President

## 20B. SIGNATURE

Christian T. Bratlien

## 20C. OFFER DATE

15 APRIL 99

## AWARD (To be completed by Government)

## 21. ITEMS ACCEPTED

0001, 0002, 0003, 0004, and 0005

## 22. AMOUNT

\$7,549,400

## 23. ACCOUNTING AND APPROPRIATION DATA

See alterations in contract

## 24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified)

ITEM

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## 25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c) ( )☐ 41 U.S.C. 283(c) ( )

## 26. ADMINISTERED BY

CODE

Fort Lewis Area Office  
USAED, Seattle  
PO Box 92146  
Tillicum, WA 98492-0146

## 27. PAYMENT WILL BE MADE BY

US Army Corps of Engineers Finance Center  
CEFC-AO-P  
5720 Integrity Drive  
Millington, TN 38054-5005

## CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this

document and return copies to the issuing office.) Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.

☒ 29. AWARD. (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

## 30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)

## 31A. NAME OF CONTRACTING OFFICER (Type or print)

Kent R. Paul

## 30B. SIGNATURE

## 30C. DATE

## 31B. UNITED STATES OF AMERICA

BY

## 31C. AWARD DATE

99MAY07

IFB No.: DACA67-99-B-0024  
Contract No.: DACA67-99-C-0030

## **ALTERATIONS IN CONTRACT**

**(FAR 52.252-4) (APR 1984)**

### **PORTIONS OF CONTRACT ARE ALTERED AS FOLLOWS:**

1. Block 23 of SF 1442, Accounting and Appropriation Data, is revised as follows:

219 20860000 088082 320000 29V0199 10038000 ARMC 35026

2. Small Business Subcontracting Plan is added as pages

00010-2(b) through 00010-2(h)

3. Page entitled Design Authentication is renumbered to 00800-10(a).

00010-2(a)

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SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED  
SMALL BUSINESS SUBCONTRACTING PLAN

DATE: April 28, 1999

CONTRACTOR: Wick Constructors, Inc.  
ADDRESS: 720 N. 35th St., P.O. Box 31509, Seattle, WA 98103  
PHONE NO: 206-634-1550  
PROJECT TITLE: USARC/OMS/MEP – Phase 2, Fort Lawton, WA  
SOLICITATION NO.: DACA67-99-B-0024

Wick Constructors, Inc. hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. Wick Constructors further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of Wick Constructors' compliance with this clause.

In accordance with the contract clauses at 52.219-8 and 52.219-9, Wick Constructors, Inc. submits the following Subcontracting Plan for small business, HUBZone small business, small disadvantaged business and women-owned small business concerns.

1. The following percentage goals are applicable to the contract awarded under the solicitation cited above.

a. The total estimated percentage of all planned subcontracting to all types of business concerns under this contract is: 72.05%

b. Small Business Concerns: 80.17% of total planned subcontracting dollars under this contract will go to subcontractors who are small business concerns including 1c, 1d and 1e.

c. HUBZone Small Business Concerns: 0% of total planned subcontracting dollars under this contract will go to subcontractors who are HUBZone small business concerns.

d. Small Disadvantaged Business Concerns: 12.86% of total planned subcontracting dollars under this contract will go to subcontractors who are small disadvantaged individuals.  
NOTE: Women-owned business are not considered a small disadvantaged business.

e. Small Women-Owned Business Concerns: 5.46% of total planned subcontracting dollars under this contract will go to the subcontractors who are small woman-owned businesses.

2. Corresponding dollar values for percentages cited in para. 1:
- a. Total contract amount is \$7,513,543.
  - b. Total dollars planned to be subcontracted: \$5,413,171.
  - c. Total dollars planned to be subcontracted to small business concerns: \$4,339,702.
  - d. Total dollars planned to be subcontracted to HUBZone small business concerns: \$-0-.
  - e. Total dollars planned to be subcontracted to small disadvantaged business concerns: \$695,982.
  - f. Total dollars planned to be subcontracted to small women-owned business concerns: \$295,741.
3. The following principal products and/or services will be subcontracted under this contract:
- a. Products/services planned to be subcontracted to SB concerns:  
Excavation, asphalt, landscaping, reinforcing steel, masonry, aluminum windows,  
GWB, flooring, roofing, electrical and mechanical
  - b. Products/services planned to be subcontracted to HUBZone SB concerns:  
None
  - c. Products/services planned to be subcontracted to SDB concerns:  
Landscaping and windows
  - d. Products/services planned for subcontracting to WOB concerns:  
Landscaping and flooring

4. The following method was used to develop above subcontracting goals (i.e., statement explaining how the product and services areas to be subcontracted were established, how the areas to be subcontracted were established, how the areas to be subcontracted to SB and SDB concerns were determined, and how SB and SDB concerns' capabilities were determined).

All divisions of work were open to subcontracting. We determined the areas to be subcontracted based on the competitive bid process. Those selected were the low responsible bidder. Capabilities were determined through phone conversations/past experience with bidder.

5. The following method was used to identify potential sources for solicitation purposes in developing the above subcontracting goals:

All divisions of work were open to subcontracting. We determined the areas to be subcontracted based on the competitive bid process. Those selected were the low responsible bidder. Capabilities were determined through phone conversations/past experience with bidder. We published advertisements for bids in printed form through news media. Other resources utilized include notification via BidFax and the Procurement Marketing and Access Network (PRO-NET) of the Small Business Administration (SBA).

6. Indirect and overhead costs \_\_\_\_ have X have not been included in the goals specified in 1 and 2 above.

If "have been" is checked, explain the method used in determining the proportionate share of indirect and overhead costs to be allocated as subcontracts to SB concerns, HUBZone SB concerns, SDB concerns and WOSB concerns, and the products and services planned.

\_\_\_\_\_  
\_\_\_\_\_

7. The following employee will administer the subcontracting program:

NAME: Rocky Gerber  
ADDRESS: P.O. Box 31509, Seattle, WA 98103  
TELEPHONE NO.: 206-634-1550 FAX NO.: 206-634-1565  
TITLE: Project Manager

This individual's specific duties, as they relate to the firm's subcontracting program, are as follows:

General overall responsibility for this company's Small Business Program, the development, preparation and execution of individual subcontracting plans and for monitoring performance relative to contractual subcontracting requirements contained in this plan, including, but not limited to:

- Developing and maintaining bidders lists of SB and SDB concerns from all possible sources.
- Ensuring that procurement packages are structured to permit SB and SDB concerns to participate to the maximum extent possible.
- Assuring inclusion of small and SDB concerns in all solicitations for products or services which they are capable of providing.
- Reviewing solicitations to remove statements, clauses, etc., which may tend to restrict or prohibit SB and SDB participation.
- Ensuring periodic rotation of potential subcontractors on bidders lists.
- Ensuring that the bid proposal review board documents its reasons for not selecting low bids submitted by SB and SDB concerns.
- Ensuring the establishment and maintenance of records of solicitations and subcontract award activity.
- Attending or arranging for attendance of company counselors at Business Opportunity Workshops, Minority Business Enterprise Seminars, Trade Fairs, etc.
- Conducting or arranging for conduct of motivational training for purchasing personnel pursuant to the intent of P.L. 95-507.
- Monitoring attainment of proposed goals.
- Preparing and submitting required periodic subcontracting reports.
- Coordinating Contractor's activities during the conduct of compliance reviews by Federal agencies.
- Coordinating the conduct of contractor's activities involving its small and small disadvantaged business subcontracting program.
- Additions to (or deletions from) the duties specified above are as follows:

Responsible for developing and writing subcontracts

8. The following efforts will be taken to assure that SB, HUBZone SB, SDB and WOSB concerns will have an equitable opportunity to compete for subcontracts.
  - a. Outreach efforts will be made as follows:
    - (i) Maintain contacts with minority and small business trade associations.
    - (ii) Maintain contacts with business development organizations.
    - (iii) Attend small and minority business procurement conference and trade fairs.
  - b. The following internal efforts will be made to guide and encourage buyers:
    - (i) Workshops, seminars and training programs will be conducted.
    - (ii) Activities will be monitored to evaluate compliance with this subcontracting plan.
    - (iii) Arrange interviews with SDB, HUBZone SB and WOSB contractors, and attend available workshops.
  - c. Small and SDB concern source lists, guides and other data identifying SB and SDB concerns will be maintained and utilized by buyers in soliciting subcontracts.
  - d. The Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration will be reviewed.
9. Wick Constructors agrees that the clause entitled "Utilization of Small Business Concerns" will be included in all subcontracts that offer further subcontracting opportunities, and Wick Constructors will require all subcontractors (except SB concerns) that receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan that complies with the requirements of this clause. The acceptability of percentage goals shall be determined on a case-by-case basis depending on the supplies/services involved, the availability of potential small and small disadvantaged subcontractors, and prior experience. Once approved and implemented, plans will be monitored through the submission of periodic reports, and/or, as time and availability of funds permit, periodic visits to subcontracting program progress.

10. Wick Constructors agrees to submit such periodic reports and cooperate in any studies or surveys as may be required by the contracting agency or the Small Business Administration in order to determine the extent of compliance by the bidder (contractor) with the subcontracting plan and with clause entitled "Utilization of Small Business Concerns" contained in the contract, submit SF 294 Subcontracting Report for Individual Contracts and/or SF 295 Summary Subcontract Report, and ensure our subcontractors agree to submit SF 294 and 295.
11. Wick Constructors agrees that it will maintain at least the following types of records to document compliance with this subcontracting plan:
  - a) Source lists (PRO-Net), guides and other data that identify small business, HUBZone small business, small disadvantaged business and women-owned small business concerns.
  - b) Organizations contacted in an attempt to locate sources that are SB, HUBZone SB, SDB and WOSB concerns.
  - c) On a contract-by-contract basis, records on all subcontract solicitations over \$100,000, indicating for each solicitation (1) whether SB concerns were solicited, and if not, why not; (2) whether HUBZone SB concerns were solicited, and if not, why not; (3) whether SDB concerns were solicited, and if not, why not, (4) whether WOSB concerns were solicited, and if not, why not, and (5) reasons for the failure of solicited SB, HUBZone SB, SDB and WOSB concerns to receive the subcontract award.
  - d) Records to support other outreach efforts, e.g., contacts with Minority and Small Business Trade Associations, business development organizations, and attendance at SB, HUBZone SB, SDB and procurement conferences and trade fairs.
  - e) Records of internal guidance and encouragement provided to buyers through workshops, seminars, training, etc., and monitoring performance to evaluate compliance with the program's requirements.
  - f) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address and business size of each subcontractor.

12. In order to effectively implement this plan to the extent consistent with efficient contract performance, Wick Constructors shall perform the following functions:

- a) Assist SB, HUBZone SB, SDB and WOSB concerns by arranging solicitations, time for the preparation of bids, quantities, specifications and delivery schedules so as to facilitate the participation by such concerns. Where Wick lists of potential SB, HUBZone SB, SDB and WOSB subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.
- b) Provide adequate and timely consideration of the potentialities of SB, HUBZone SB, SDB and WOSB concerns in all "make-or-buy" decisions.
- c) Counsel and discuss subcontracting opportunities with representative of SB, HUBZone SB, SDB and WOSB firms.
- d) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as SB, HUBZone SB, SDB and WOSB for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

13. Wick Constructors will submit an SF 295, Summary Subcontract Report, on Corps of Engineers projects only. The SF 295 shall be completed and distributed in accordance with the Corps of Engineers Supplemental Instruction. Wick Constructors will not report Corps of Engineers projects through any other Agency unless authorized by the Contracting Officer.

14. In closing, Wick Constructors states that it will be the policy of Wick Constructors to afford every practicable opportunity for small, HUBZone small, small disadvantaged, and women-owned small business concerns to participate in contracts awarded to Wick Constructors by the Federal Government, to ensure that equitable opportunity is provided to small, small disadvantaged, and women-owned small business concerns to compete for award of subcontracts and purchase orders, and to diligently pursue the achievement of our goals of participation by small, small disadvantaged, and women-owned small business in the dollars available for subcontract/purchase order awards under this contract.

SIGNED:  DATE: April 28, 1999

TYPED NAME: Christian T. Bratlien

TITLE: President

PLAN REVIEWED BY: Rocky Gerber DATE: April 28, 1999  
SMALL BUSINESS SPECIALIST

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IFB No: DACA67-99-B-0024


Contract No.: DACA67-99-C-0030

IF THE CONTRACTOR IS A CORPORATION OR PARTNERSHIP, THE APPLICABLE FORM LISTED BELOW MUST BE COMPLETED. IN THE ALTERNATIVE, OTHER EVIDENCE MUST BE SUBMITTED TO SUBSTANTIATE THE AUTHORITY OF THE PERSON SIGNING THE CONTRACT. IF A CORPORATION, THE SAME OFFICER SHALL NOT EXECUTE BOTH THE CONTRACT AND THE CERTIFICATE.

## CORPORATE CERTIFICATE

I, David C. Shadle, certify that I am the Corporate Secretary of the corporation named as Contractor herein; that Christian T. Bratlien, who signed this contract on behalf of the Contractor was then President of said corporation; that said contract was duly signed for and on behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

WICK CONSTRUCTORS, INC.

 (CORPORATE SEAL)  
(Secretary)  
David C. Shadle

## AUTHORITY TO BIND PARTNERSHIP

This is to certify that the names, signatures and Social Security Numbers of all partners are listed below and that the person signing the contract has authority actually to bind the partnership pursuant to its partnership agreements. Each of the partners individually has full authority to enter into and execute contractual instruments on behalf of said partnership with the United States of America, except as follows: (state "none" or describe limitations, if any).

This authority shall remain in full force and effect until such time as the revocation of authority by any cause whatsoever has been furnished in writing to, and acknowledged by, the Contracting Officer.

(Names, Signatures and Social Security Numbers of all Partners)

NAME	SIGNATURE	SOCIAL SECURITY NO.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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IFB No: DACA67-99-B-0024  
Contract No: DACA67-99-C-0030

## BID SCHEDULE

<u>Item No.</u>	<u>Description of Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
BASE ITEMS					
0001	All work for USARC/OMS Phase Two Training Building within a line 1.5 meters outside the building wall line, except for Optional Items 0003, 0004 and 0005	1	Job	LS	\$ <u>6,880,000</u>
0002	All work for sitework and utilities beyond the line 1.5 meters outside the building wall line, except landscaping shown on sheet C7.1 and C7.2.	1	Job	LS	\$ <u>480,000</u>
TOTAL BASE ITEMS					\$ <u>7,360,000</u>
OPTIONAL ITEMS					
0003	All work for loading dock extension	1	Job	LS	\$ <u>32,400</u>
0004	All work for landscaping as shown on sheet C7.1	1	Job	LS	\$ <u>63,300</u>
0005	All work for landscaping as shown on sheet C7.2	1	Job	LS	\$ <u>93,700</u>
TOTAL OPTIONAL ITEMS					\$ <u>189,400</u>
TOTAL BASE AND OPTIONAL ITEMS					\$ <u>7,549,400</u>

NOTE: See Special Clause SC-1.1 for awarding Optional Items 0003, 0004 and 0005.

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FROM: US ARMY ENGR DIST, SEATTLE  
PO BOX 3755  
SEATTLE, WA 98124-2255  
(206)764-6801, CENWS-CT-CB-MU, Nancy Briar

1. Refer to Invitation for Bid DACA67-99-B-0024 dated 19 February 1999, entitled, USARC/OMS/MEP-Phase 2, Fort Lawton, WA.

2. This Telegraphic Amendment No. Six (0006), dated 5 April 1999, provides for the following:

a. Technical Specification Section 08710, Paragraph 3.6 Schedules is revised to Delete the HS designation from all locksets listed within the sets.

b. a. Bid Opening Time and Date is extended to:

1:00 P.M., Local Time, 15 APRIL 1999

3. NOTICE TO BIDDERS: Bidder must acknowledge receipt of this amendment by number and date on bid or by telegram. Please mark outside of envelope in which bid is enclosed to show amendment received.

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## AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE

PAGE OF PAGES

1 2

2. AMENDMENT/MODIFICATION NO.

0005

3. EFFECTIVE DATE

03/30/99

4. REQUISITION/PURCHASE REQ. NO.

W68MD9-9004-2842

5. PROJECT NO. (If applicable)

83001

6. ISSUED BY

CODE

W68MD9

7. ADMINISTERED BY (If other than Item 6)

CODE

US ARMY ENGINEER DISTRICT, SEATTLE

PO BOX 3755

SEATTLE WA 98124-3755

Nancy L Briar

C02 (206) 764-6801

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code) Vendor ID: 00000000

N/A

X WA 00000

(X)

X

9A. AMENDMENT OF SOLICITATION NO.

DACA67-99-B-0024

9B. DATED (SEE ITEM 11)

02/19/99

10A. MODIFICATION OF CONTRACT/ORDER NO.

10B. DATED (SEE ITEM 13)

CODE

FACILITY CODE

## 11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

## 13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(X) A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103 (b).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

USARC/OMS/MEP - Phase 2, Fort Lawton, Washington

DACA67-99-B-0024, Amendment No. 0005

1. This Amendment No. 0005, dated 30 March 1999, provides for the following Changes:

a. Revised SF 1442 is included with this amendment.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)

16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)

15B. CONTRACTOR/OFFEROR

15C. DATE SIGNED

16B. UNITED STATES OF AMERICA

16C. DATE SIGNED

(Signature of person authorized to sign)

BY

(Signature of Contracting Officer)

SF 30 CONTINUATION SHEET

b. Bid Schedule is revised.

c. Section 00100, Delete Clause No. 18, FAR 52.217-4, "Evaluation of Options Exercised at Time of Contract Award".

d. Section 00700, Delete Clause NO. 17, Far 52.211-18, "Variation in Estimated Quantities".

e. Sketches have been added and modifications to drawings by notation are included in Section 00800.

f. Table of Contents, for technical sections, is reissued.

g. Section 07250, "Sprayed Fireproofing", is deleted from Table of Contents.

h. Technical changes are reflected in Sections 05120, 07416, 09520, 10440, 10508, 10552, 11400, 11470, 15430, and 15440.

2. The attached revised sections are hereby added and substituted for the superceded sections. Side bars denote location of changes.

3. Bid Opening Time and Date Remain:

12:00 (noon) P.M. Local Time, 8 April 1999

4. Notice to Bidders: Bidders MUST acknowledge receipt of this amendment by number and date on the bid or by telegram. Please mark outside of envelope in which bid is enclosed to show amendment received.

Encls:

1. Revised SF 1442
2. Rev Bid Schedule
3. Rev Section 00100
4. Rev Section 00700
5. Rev Section 00800
6. Rev Table of Contents
7. Rev Tech Sections 05120, 07416, 09520, 10440, 10508, 10552, 11400, 10470, 15430 and 15440



FROM: US ARMY ENGR DIST, SEATTLE  
PO BOX 3755  
SEATTLE, WA 98124-2255  
(206)764-6801, CENWS-CT-CB-MU, Nancy Briar

1. Refer to Invitation for Bid DACA67-99-B-0024 dated 19 February 1999, entitled, USARC/OMS/MEP-Phase 2, Fort Lawton, WA.

2. This Telegraphic Amendment No. Four (0004), dated 26 March 1999, provides for the following:

a. Bid Opening Time and Date are extended to:

12:00 P.M.(NOON) Local Time, 8 APRIL 1999

b. Amendment No. Five (0005) with technical changes is forthcoming.

3. NOTICE TO BIDDERS: Bidder must acknowledge receipt of this amendment by number and date on bid or by telegram. Please mark outside of envelope in which bid is enclosed to show amendment received.

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FROM: US ARMY ENGR DIST, SEATTLE  
PO BOX 3755  
SEATTLE, WA 98124-2255  
(206) 764-6588, CENWS-CT-CB-MU, Margaret Gillam

1. Refer to Invitation for Bid DACA67-99-B-0024 dated 19 February 1999, entitled, USARC/OMS/MEP-Phase 2, Fort Lawton, WA.

2. This telegraphic Amendment No. Three (0003), dated 24 March 1999, provides for the following:

a. Reference Amendment #1, Disk 3 of 3. For those disks issued prior to 24 March 1999, you may need to fix an error entitled Insert "Phladd1." To do so, please do the following:

(1) If you do not have Source View Reader on your computer, install it now by inserting the EBS disk, go to the rectangular box entitled Contract Viewer and click on File, Installs, Source View Reader.

(2) If you do have Source View Reader installed previously, ignore number 1.

(3) Insert Disk 3 of 3 and go into Windows Explorer; go to where your floppy lives and click on the drive.

(4) This will show you what is on the disk. Click on the yellow folder called R1\_Plans. This will bring us the contents of the folder. You may now view the drawings by clicking on List.svd. Please be aware of the fact that the first drawing listed (S4-2), is on Disk 2 of 3 and the drawing will say Cannot Open File. Go to the tool bar at the top of the page, click on File, Page List and highlight the drawing you wish to view.

(5) Drawings S1-1, S2-1, S3-1, and S4-2 are on Disk 2 of 3.

(6) Drawings S5-1r, S5-3r, S5-4r, and S5-5 are on Disk 3 of 3.

3. NOTICE TO BIDDERS: The bid opening date and time remain unchanged as:

1:00 P.M. Local Time, 30 March 1999

4. NOTICE TO BIDDERS: Bidder must acknowledge receipt of this amendment by number and date on bid or by telegram. Please mark outside of envelope in which bid is enclosed to show amendment received.

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FROM: US ARMY ENGR DIST, SEATTLE  
PO BOX 3755  
SEATTLE, WA 98124-2255  
(206) 764-6801, CENWS-CT-CB-MU, Nancy Briar

1. Refer to Invitation for Bid DACA67-99-B-0024 dated 19 February 1999, entitled, USARC/OMS/MEP-Phase 2, Fort Lawton, WA.
2. This Telegraphic Amendment No. Two (0002), dated 12 February 1999, provides for the following:  
  
    Bid Opening Time and Date are extended to: 1:00 P.M. Local Time, 30 March 1999.
3. Amendment No. One (0001) with technical changes is forthcoming.
4. NOTICE TO BIDDERS: Bidders must acknowledge receipt of this amendment by number and date on bid or by telegram. Please mark outside of envelope containing bid to show amendment received.

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## AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE

PAGE OF PAGES

1 2

2. AMENDMENT/MODIFICATION NO.

0001

3. EFFECTIVE DATE

03/19/99

4. REQUISITION/PURCHASE REQ. NO.

W69MD9-9004-2042

5. PROJECT NO. (If applicable)

83001

6. ISSUED BY

CODE

W69MD9

7. ADMINISTERED BY (If other than Item 6)

CODE

US ARMY ENGINEER DISTRICT, SEATTLE

PO BOX 3755

SEATTLE WA 98126-3755

Nancy L Briar

C02 (206) 766-6801

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)

(X)

9A. AMENDMENT OF SOLICITATION NO.

DACA67-99-B-0024

X

9B. DATED (SEE ITEM 11)

02/19/99

10A. MODIFICATION OF CONTRACT/ORDER NO.

10B. DATED (SEE ITEM 13)

CODE

FACILITY CODE

## 11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

## 13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

☒ A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

☐ B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation data, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.102 (b).

☐ C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

☐ D. OTHER (Specify type of modification and authority)

**E. IMPORTANT:** Contractor ☐ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

USARC/OMS/NEP - Phase 2, Fort Lawton, Washington

DACA67-99-B-0024, Amendment No. 0001

1. This Amendment No. 0001, dated March 19, 1999, provides for the following changes:

a. Section 00100 is revised to include clause 52-219-0004

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)

16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)

15B. CONTRACTOR/OFFEROR

15C. DATE SIGNED

16B. UNITED STATES OF AMERICA

16C. DATE SIGNED

(Signature of person authorized to sign)

BY

(Signature of Contracting Officer)

NSN 7540-01-152-8070

PREVIOUS EDITION UNUSABLE

30-105

STANDARD FORM 30 (REV. 10-83)  
Prescribed by GSA  
FAR (48 CFR) 53.243

SF 30 CONTINUATION SHEET

entitled, "Notice of Price Evaluation Preference for HUBZone Small Business Concerns". The section is revised and replaced in its entirety.

b. 00800 is reissued in its entirety to provide for revisions to Index of Drawings and added modifications to contract drawings.

c. General Decision WA980002 dated Jan 8, 1999 is revised and replaced by General Decision WA990002 dated 3/12/99. The revised decision is incorporated in its entirety.

d. Technical Section 16421 is revised and replaced in its entirety.

e. The following drawings are revised and added:

S1.1, S2.2, S3.1, S4.2, S5.1, S5.3, S5.4 and S5.5

f. A revised SF 1442 is included with this amendment.

2. The attached revised sections are hereby added and substituted for the superceded sections. Side Bars denote location of changes.

3. Bid Opening Time and Date Remains:

1:00 P.M. Local Time, 30 March 1999

4. Notice to Bidders: Bidders MUST acknowledge receipt of this amendment by number and date on the bid or by telegram. Please mark outside of envelope in which bid is enclosed to show amendments received.

Encls

1. Revised SF 1442
2. Revised Section 00100
3. Revised Section 00800
4. Revised General Decision No. WA990002 dated 3/12/99
5. Revised Section 16421
6. Revised drawings, S1.1, S2.2, S3.1, S4.2, S5.1, S5.3, S5.4 and S5.5



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## SECTION 00700

## CONTRACT CLAUSES

## 1 52. 252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at these addresses:

<http://www.arnet.gov/far>  
<http://farsite.hill.af.mil>  
<http://www.dtic.mil/dfars>  
 (End of clause)

## 2 52. 201-4001 SUCCESSOR CONTRACTING OFFICERS (52. 0201-4001)

The Contracting Officer who signed this contract is the primary Contracting Officer for the contract. Nevertheless, any Contracting Officer assigned to the Seattle District and acting within his/her authority may take formal action on this contract when a contract action needs to be taken and the primary Contracting Officer is unavailable.

## 3 52. 201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)

(a) Definition. "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.  
 (End of clause)

## 4 52. 202-1 I DEFINITIONS (OCT 1995) -- ALTERNATE I (APR 1984)

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) Commercial component means any component that is a commercial item.

(c) Component means any item supplied to the Federal Government as part of an end item or of another component.

(d) Nondevelopmental item means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense

cooperation agreement;

(2) Any item described in paragraph (e)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (e)(1) or (e)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

5 52.203-3 GRATUITIES (APR 1984)

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) above, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

(R 7-104.16 1952 MAR)

6 52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose

of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a Contractor and subject to the Contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)  
(R 7-103.20 1958 JAN)  
(R 1-1.503)  
(R 1-7.102-18)

7 52.203-7 ANTI-KICKBACK PROCEDURES (JUL 1995)

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from -

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

(End of clause)

8      52. 203-8              CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR  
ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense

punishable under subsection 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

9      52. 203-10      PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY  
(JAN 1997)

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.



(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

10      52. 203- 12      LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL  
TRANSACTIONS (JUN 1997)

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2. 101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U. S. C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.
- (2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.
- (3) A special Government employee, as defined in section 202, title 18, United States Code.
- (4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or

employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific

solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example,

communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a

civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

# 11 52. 203- 7001 SPECIAL PROHIBITION ON EMPLOYMENT (JUN 1997)

(a) Definitions.

As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain,

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) 10 U.S.C. 2408 provides that any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from:

(1) Working in a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) Serving on the board of directors of any DoD Contractor or first-tier subcontractor; or

(3) Serving as a consultant to any DoD Contractor or first-tier subcontractor.

(c) Unless waived, the prohibition in paragraph (b) applies for five years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense Contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the Contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibitions in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver; and,

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

(End of clause)

12 52.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991)

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

13 52.204-4 PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996)

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper, such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standard is 50 percent recovered material content of certain industrial by-products.

(End of clause)

14 52.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the Contractor.

(End of clause)

15      52. 209- 6      PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING  
WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR  
DEBARMENT (JUL 1995)

(a) The Government suspends or debar Contractors to protect the Government's interest. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of clause)

16      52. 209- 7004      SUBCONTRACTING WITH FIRMS THAT ARE OWNED OR CONTROLLED BY  
THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) Unless the Government determines that there is a compelling reason to do so, the Contractor shall not enter into any subcontract in excess of \$25,000 with a firm, or a subsidiary of a firm, that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country.

(b) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country. The notice must include the name of the proposed subcontractor and the compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(End of clause)

17      52. 214- 26      AUDIT AND RECORDS-- SEALED BIDDING (OCT 1997)

(a) As used in this clause, records includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Cost or pricing data. If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

18      52. 214- 27      PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--  
MODIFICATIONS-- SEALED BIDDING (OCT 1997)

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the



Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the

Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

19      52.214-28      SUBCONTRACTOR COST OR PRICING DATA-- MODIFICATIONS-- SEALED BIDDING (OCT 1997)

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

20      52.214-29      ORDER OF PRECEDENCE-- SEALED BIDDING (JAN 1986)

Any inconsistency in this solicitation or contract shall be resolved by giving precedence in the following order: (a) the Schedule (excluding the specifications); (b) representations and other instructions; (c) contract clauses; (d) other documents, exhibits, and attachments; and (e) the specifications.

(End of clause)

21      52.219-8      UTILIZATION OF SMALL BUSINESS CONCERNS (JAN 1999)

(a) It is the policy of the United States that small business concerns, HUBZone small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals, and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to

ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, HUBZone small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals, and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) Definitions. As used in this contract

(1) Small business concern means a small business as defined pursuant to section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

(2) HUBZone small business concern means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(3) Small business concern owned and controlled by socially and economically disadvantaged individuals means a small business concern that represents, as part of its offer, that it meets the definition of a small disadvantaged business concern in 13 CFR 124.1002.

(4) Small business concern owned and controlled by women means a small business concern--

(i) Which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(ii) Whose management and daily business operations are controlled by one or more women; and

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a HUBZone small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals, or a small business concern owned and controlled by women.

(End of clause)

22 52.219-9 I SMALL BUSINESS SUBCONTRACTING PLAN (JAN 1999)--ALTERNATE I  
(JAN 1999)

(a) This clause does not apply to small business concerns.

(b) Definitions. As used in this clause--

Commercial item means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

Commercial plan means a subcontracting plan (including goals) that covers the offeror's fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

Individual contract plan means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror's planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

Master plans means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

Subcontract means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, that separately addresses subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to HUBZone small business concerns;

(iv) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(v) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to--

(i) Small business concerns;

(ii) HUBZone small business concerns;

(iii) Small disadvantaged business concerns; and

(iv) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), the list of certified small disadvantaged business concerns of the SBA, the National Minority

Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone small, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small and women-owned small business source list. A firm shall rely on the information contained in SBA's list of small disadvantaged business concerns as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small disadvantaged business source list. Use of PRO-Net and/or the SBA list of small disadvantaged business concerns as its source lists does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with--

- (i) Small business concerns;
- (ii) HUBZone small business concerns;
- (iii) Small disadvantaged business concerns; and
- (iv) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will--

- (i) Cooperate in any studies or surveys as may be required;
- (ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;
- (iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms or as provided in agency regulations and in paragraph (j) of this clause; and
- (iv) Ensure that its subcontractors agree to submit SF 294 and SF 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise

indicated):

- (i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.
- (ii) Organizations contacted in an attempt to locate sources that are small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.
- (iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating--
  - (A) Whether small business concerns were solicited and, if not, why not;
  - (B) Whether HUBZone small business concerns were solicited and, if not, why not;
  - (C) Whether small disadvantaged business concerns were solicited and, if not, why not;
  - (D) Whether women-owned small business concerns were solicited and, if not, why not; and
  - (E) If applicable, the reason award was not made to a small business concern.
- (iv) Records of any outreach efforts to contact--
  - (A) Trade associations;
  - (B) Business development organizations; and
  - (C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources.
- (v) Records of internal guidance and encouragement provided to buyers through--
  - (A) Workshops, seminars, training, etc.; and
  - (B) Monitoring performance to evaluate compliance with the program's requirements.
- (vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.
- (e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:
  - (1) Assist small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.
  - (2) Provide adequate and timely consideration of the potentialities of small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.
  - (3) Counsel and discuss subcontracting opportunities with representatives of small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.
  - (4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, HUBZone small, small disadvantaged, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or

all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided-- (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization Of Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) Standard Form 294, Subcontracting Report for Individual Contracts. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) Standard Form 295, Summary Subcontract Report. This report encompasses all the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by Standard Industrial Classification (SIC) Major Group. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant SIC Major Group and report all awards to that subcontractor under its predominant SIC Major Group.

(End of clause)

23      52. 219- 16      LIQUIDATED DAMAGES-- SUBCONTRACTING PLAN (JAN 1999)

(a) "Failure to make a good faith effort to comply with the subcontracting plan," as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage

goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion or, in the case of a commercial plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer who approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies with contracts covered by the commercial plan.

(e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.

(f) Liquidated damages shall be in addition to any other remedies that the Government may have.

(End of clause)

24 52. 222-3 CONVICT LABOR (AUG 1996)

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--



(a)(1) The worker is paid or is in an approved work training program on a voluntary basis;

(2) Representatives of local union central bodies or similar labor union organizations have been consulted;

(3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and

(4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

25      52. 222- 4      CONTRACT WORK HOURS AND SAFETY STANDARDS ACT-- OVERTIME  
COMPENSATION (JUL 1995)

(a) Overtime requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22. 300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1 1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) Payrolls and basic records. (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the

contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts exceeding \$100,000, the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

26      52.222-6      DAVIS-BACON ACT (FEB 1995)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the

wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

- (i) The work to be performed by the classification requested is not performed by a classification in the wage determination.
- (ii) The classification is utilized in the area by the construction industry.
- (iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (iv) With respect to helpers, such a classification prevails in the area in which the work is performed.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

## 27 52. 222-7 WITHHOLDING OF FUNDS (FEB 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

## 28 52. 222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her

agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

29 52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U. S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not

registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

30 52. 222- 10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

31 52. 222- 11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

32 52. 222- 12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

33 52. 222- 13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

## 34 52. 222- 14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees of their representatives.

(End of clause)

## 35 52. 222- 15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

## 36 52. 222- 23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
7.2%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities



and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U. S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the--

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is Washington, King, Seattle.

(End of provision)

(R 7-2003.14(d) 1978 SEP)

37 52. 222-26 EQUAL OPPORTUNITY (FEB 1999)

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) of this clause. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(b) During performance of this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative

of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EE0-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

38      52. 222- 27      AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR  
CONSTRUCTION (FEB 1999)

(a) Definitions.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means the Deputy Assistant Secretary for Federal Contract Compliance, U. S. Department of Labor, or a designee.

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U. S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U. S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as

amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g) (2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all

minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user rest rooms and necessary dressing or sleeping areas shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its

obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

- (1) Actively participates in the group;
- (2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;
- (3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;
- (4) Makes a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

- (1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;
- (2) Submit reports as may be required by the Government; and
- (3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other

area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).  
(End of clause)

39      52. 222-35      AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF  
THE VIETNAM ERA (APR 1998)

(a) Definitions. As used in this clause--

"All employment openings" includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

"Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area where the employment opening is to be filled, including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

"Positions that will be filled from within the Contractor's organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

"Veteran of the Vietnam era" means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and
- (viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) Listing openings. (1) The Contractor agrees to list all

employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of \$10,000 or more shall also list all employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) Applicability. This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) Postings. (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam era.

(f) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)



40      52. 222- 36      AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES  
(JUN 1998)

(a) General. (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

- (i) Recruitment, advertising, and job application procedures;
  - (ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;
  - (iii) Rates of pay or any other form of compensation and changes in compensation;
  - (iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;
  - (v) Leaves of absence, sick leave, or any other leave;
  - (vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;
  - (vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;
  - (viii) Activities sponsored by the Contractor, including social or recreational programs; and
  - (ix) Any other term, condition, or privilege of employment.
- (2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings. (1) The Contractor agrees to post employment notices stating--

- (i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and
  - (ii) The rights of applicants and employees.
- (2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.

(c) Noncompliance. If the Contractor does not comply with the

requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.  
(End of clause)

41      52. 222- 37      EMPLOYMENT REPORTS ON    DISABLED VETERANS AND VETERANS OF  
THE VIETNAM ERA (JAN 1999)

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workforce of the Contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100. "

(c) Reports shall be submitted no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1st of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EE0-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.  
(End of clause)

42      52. 223- 2      CLEAN AIR AND WATER (APR 1984)

(a) "Air Act", as used in this clause, means the Clean Air Act (42 U.S.C. 7401, et seq.).

"Clean air standards," as used in this clause, means--

(1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;

(2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));

(3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or

(4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

"Clean water standards," as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

"Compliance," as used in this clause, means compliance with--

(1) Clean air or water standards; or

(2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

"Facility," as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

"Water Act," as used in this clause, means Clean Water Act (33 U.S.C. 1251, et seq.).

(b) The Contractor agrees--

(1) To comply with all the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;

(3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and

(4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).

(End of clause)

(R 7-103.29 1975 OCT)

(R 1-1.2302)

## 43 52. 223-6 DRUG-FREE WORKPLACE (JAN 1997)

(a) Definitions. As used in this clause--

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation

occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency, and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

#### 44 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 1996)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process, or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in Section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

45      52.223-7005      RESERVED

46      52.225-5      BUY AMERICAN ACT--CONSTRUCTION MATERIALS (JUN 1997)

(a) The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic construction material.

"Components," means those articles, materials, and supplies incorporated directly into construction materials.

"Construction materials," means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Domestic construction material," means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

(b)(1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the excepted construction material or components listed by the Government as follows:

%%Insert list of applicable accepted materials or indicate "none"

(3) Other foreign construction material may be added to the list in

paragraph (b)(2) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(4) The Contractor agrees that only domestic construction material will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(2) of this clause.

(c) Request for determination. (1) Contractors requesting to use foreign construction material under paragraph (b)(3) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(3) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(3)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

### Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) +
Item 1:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....
Item 2:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....

List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

+ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).  
(End of clause)

#### 47      52. 225- 11      RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (AUG 1998)

(a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States by Executive order or regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, North Korea, and Sudan.

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.

(c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

#### 48      52. 225- 15      BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997)

(a) Definitions. As used in this clause--

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated



country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b)(1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:

%%Insert list of applicable accepted materials or indicate "none"

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or (iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, NAFTA country construction materials, or designated country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) Request for determination.

(1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a

description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) +
Item 1:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....
Item 2:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....
List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.			

+ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

(End of clause)

49      52. 225- 15 I      BUY AMERICAN ACT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997)-- ALTERNATE I (MAY 1997)

(a) Definitions. As used in this clause--

"Components" means those articles, materials, and supplies incorporated directly into construction materials.

"Construction material" means an article, material, or supply brought to the construction site for incorporation into the building or work.

Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public

building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

"Designated country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

"Domestic construction material" means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

"North American Free Trade Agreement (NAFTA) country" means Canada or Mexico.

"NAFTA country construction material" means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b)(1) The Buy American Act (41 U.S.C. 10a--10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The North American Free Trade Agreement (NAFTA) provides that NAFTA construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:

%%Insert list of applicable accepted materials or indicate "none"

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or (iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials or NAFTA country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for other foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) Request for determination.

(1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

Foreign and Domestic Construction Materials Price Comparison

Construction material description	Unit of measure	Quantity	Price (dollars) +
Item 1:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....
Item 2:			
Foreign construction material.....	.....	.....	.....
Domestic construction material.....	.....	.....	.....
List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.			

+ Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

(End of clause)

50      52. 226- 1      UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (JAN 1999)

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at 52. 219- 9, Small Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52. 219.

(b) Definitions. As used in this clause:

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., Chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1542(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the self-certification of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the self-certification of a subcontractor, the Contracting Officer shall refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW, MS-334A-SIB, Washington, DC 20245. The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

(i) The estimated cost of a cost-type contract.

(ii) The target cost of a cost-plus-incentive-fee prime contract.

(iii) The target cost and ceiling price of a fixed-price incentive prime contract.

(iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive

payment of 5 percent of the amount paid to the subcontractor. Contracting Officers shall seek funding in accordance with agency procedures. The Contracting Officer's decision is final and not subject to the Disputes clause of this contract.

(End of clause)

51      52. 227-1      AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

52      52. 227-2      NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(c) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at FAR 2.101.

(End of clause)

## 53      52. 227-4              PATENT INDEMNITY-- CONSTRUCTION CONTRACTS (APR 1984)

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U. S. C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)  
(R 7-602.16 1964 JUN)

## 54      52. 227-7033           RIGHTS IN SHOP DRAWINGS (APR 1966)

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

## 55      52. 228-2              ADDITIONAL BOND SECURITY (OCT 1997)

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting officer has the right to immediately draw on the ILC.

(End of clause)

## 56      52. 228-12              PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

## 57      52. 229-3      FEDERAL, STATE, AND LOCAL TAXES (JAN 1991)

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

## 58      52. 231-7000      SUPPLEMENTAL COST PRINCIPLES (DEC 1991)

When the allowability of costs under this contract is determined in accordance with Part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with Part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)



59      52. 232- 5      PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS  
(MAY 1997)

(a) Payment of price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Date)

(d) Refund of unearned amounts. If the Contractor, after making a

certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

- (1) Notify the Contracting Officer of such performance deficiency; and
- (2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

- (i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

- (ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, liability, and reservation of rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

- (1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

- (2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for bond premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final payment. The Government shall pay the amount due the Contractor under this contract after--

- (1) Completion and acceptance of all work;
- (2) Presentation of a properly executed voucher; and
- (3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U. S. C. 3727 and 41 U. S. C. 15).

(i) Limitation because of undefinitized work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A "contract

action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest computation on unearned amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

60 52.232-17 INTEREST (JUN 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

61 52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

62 52. 232- 27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in section 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--

(1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified, 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be the 30th day after the date of the Contractor's invoice, provided a proper invoice is

received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a proper invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor.

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) Interest penalty. An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment may be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the

Federal Register semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount; and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and will be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting from such date the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period, the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract.

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) Prompt payment discounts. An interest penalty also shall be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) Additional interest penalty.

(i) A penalty amount, calculated in accordance with subdivision

(a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of \$1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands must be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmark is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii)(A) The additional penalty shall be equal to 100 percent of any original late payment interest penalty, except--

(1) The additional penalty shall not exceed \$5,000;

(2) The additional penalty shall never be less than \$25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than \$1.

(B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrued in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(A) of this clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) Contract financing payments--

(1) Due dates for recurring financing payments. If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payments shall

be made on the 14th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) Due dates for other contract financing. For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) Interest penalty not applicable. Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the



Contracting Officer.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) Third-party deficiency reports--

(1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a

deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest

penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.  
(End of clause)

63      52. 232- 33      MANDATORY INFORMATION FOR ELECTRONIC FUNDS TRANSFER  
PAYMENT (AUG 1996)

(a) Method of payment. Payments by the Government under this contract, including invoice and contract financing payments, may be made by check or electronic funds transfer (EFT) at the option of the Government. If payment is made by EFT, the Government may, at its option, also forward the associated payment information by electronic transfer. As used in this clause, the term "EFT" refers to the funds transfer and may also include the information transfer.

(b) Mandatory submission of Contractor's EFT information.

(1) The Contractor is required, as a condition to any payment under this contract, to provide the Government with the information required to make payment by EFT as described in paragraph (d) of this clause, unless the payment office determines that submission of the information is not required. However, until January 1, 1999, in the event the Contractor certifies in writing to the payment office that the Contractor does not have an account with a financial institution or an authorized payment agent, payment shall be made by other than EFT. For any payments to be made after January 1, 1999, the Contractor shall provide EFT information as described in paragraph (d) of this clause.

(2) If the Contractor provides EFT information applicable to multiple contracts, the Contractor shall specifically state the applicability of this EFT information in terms acceptable to the payment office.

(c) Contractor's EFT information. Prior to submission of the first request for payment (whether for invoice or contract financing payment) under this contract, the Contractor shall provide the information required to make contract payment by EFT, as described in paragraph (d) of this clause, directly to the Government payment office named in this contract. If more than one payment office is named for the contract, the Contractor shall provide a separate notice to each office. In the event that the EFT information changes, the Contractor shall be responsible for providing the changed information to the designated payment office(s).

(d) Required EFT information. The Government may make payment by EFT through either an Automated Clearing House (ACH) subject to the banking laws of the United States or the Federal Reserve Wire Transfer System at the Government's option. The Contractor shall provide the following information for both methods in a form acceptable to the designated payment office. The Contractor may supply this data for this or multiple contracts (see paragraph (b) of this clause).

(1) The contract number to which this notice applies.

(2) The Contractor's name and remittance address, as stated in the contract, and account number at the Contractor's financial agent.

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the Contractor official authorized to provide this information.

(4) For ACH payments only:

(i) Name, address, and 9-digit Routing Transit Number of the Contractor's financial agent.

(ii) Contractor's account number and the type of account (checking, saving, or lockbox).

(5) For Federal Reserve Wire Transfer System payments only:

(i) Name, address, telegraphic abbreviation, and the 9-digit Routing Transit Number for the Contractor's financial agent.

(ii) If the Contractor's financial agent is not directly on-line to the Federal Reserve Wire Transfer System and, therefore, not the receiver of the wire transfer payment, the Contractor shall also provide the name, address, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment.

(e) Suspension of payment.

(1) Notwithstanding the provisions of any other clause of this contract, the Government is not required to make any payment under this contract until after receipt, by the designated payment office, of the correct EFT payment information from the Contractor or a certificate submitted in accordance with paragraph (b) of this clause. Until receipt of the correct EFT information, any invoice or contract financing request shall be deemed not to be a valid invoice or contract financing request as defined in the Prompt Payment clause of this contract.

(2) If the EFT information changes after submission of correct EFT information, the Government shall begin using the changed EFT information no later than the 30th day after its receipt to the extent payment is made by EFT. However, the Contractor may request that no further payments be made until the changed EFT information is implemented by the payment office. If such suspension would result in a late payment under the Prompt Payment clause of this contract, the Contractor's request for suspension shall extend the due date for payment by the number of days of the suspension.

(f) Contractor EFT arrangements. The Contractor shall designate a single financial agent capable of receiving and processing the electronic funds transfer using the EFT methods described in paragraph (d) of this clause. The Contractor shall pay all fees and charges for receipt and processing of transfers.

(g) Liability for uncompleted or erroneous transfers.

(1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor-provided EFT information in the correct manner, the Government remains responsible for (i) making a correct payment, (ii) paying any prompt payment penalty due, and (iii) recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because Contractor-provided EFT information was incorrect at the time of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government retains the right to either make payment by mail or suspend the payment in accordance with paragraph (e) of this clause.

(h) EFT and prompt payment.

(1) A payment shall be deemed to have been made in a timely manner in accordance with the Prompt Payment clause of this contract if, in the EFT payment transaction instruction given to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(2) When payment cannot be made by EFT because of incorrect EFT information provided by the Contractor, no interest penalty is due after

the date of the uncompleted or erroneous payment transaction, provided that notice of the defective EFT information is issued to the Contractor within 7 days after the Government is notified of the defective EFT information.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the Assignment of Claims clause of this contract, the assignee shall provide the assignee EFT information required by paragraph (d) of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information which shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Payment office discretion. If the Contractor does not wish to receive payment by EFT methods for one or more payments, the Contractor may submit a request to the designated payment office to refrain from requiring EFT information or using the EFT payment method. The decision to grant the request is solely that of the Government.

(k) Change of EFT information by financial agent. The Contractor agrees that the Contractor's financial agent may notify the Government of a change to the routing transit number, Contractor account number, or account type. The Government shall use the changed data in accordance with paragraph (e)(2) of this clause. The Contractor agrees that the information provided by the agent is deemed to be correct information as if it were provided by the Contractor. The Contractor agrees that the agent's notice of changed EFT data is deemed to be a request by the Contractor in accordance with paragraph (e)(2) that no further payments be made until the changed EFT information is implemented by the payment office.

(End of clause)

64      52. 232- 7009      PAYMENT BY ELECTRONIC FUNDS TRANSFER (CCR) (JUN 1998)

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of (b) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either (i) accept payment by check or some other mutually agreeable method of payment, or (ii) request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (e) of this clause).

(b) Alternative contractor certification. If the Contractor certifies in writing, as part of its registration with the Central Contractor Registration (CCR) database that it does not have an account with a financial institution and does not have an authorized payment agent, payment shall be made by check to the remittance address contained in the CCR database. All contractor certifications will expire on January 1, 1999.

(c) Contractor's EFT information. Except as provided in paragraph (b) of this clause, the Government shall make payment to the Contractor using the EFT information contained in the CCR database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated

information to the CCR database.

(d) Mechanisms for EFT payment. The Government may make payment by EFT through either an Automated Clearing House subject to the banking laws of the United States or the Federal Reserve Wire Transfer System.

(e) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect and the Contractor has not certified under paragraph (b) of this clause, the Government need not make payment to the Contractor under this contract until correct EFT information or certification is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(f) Contractor EFT arrangements. If the Contractor has identified multiple payment receiving points (i.e., more than one remittance address or EFT information set) in the CCR database, and the Contractor has not notified the Government of the payment receiving point applicable to this contract, the Government shall make payment to the first payment receiving point (EFT information set or remittance address as applicable) listed in the CCR database.

(g) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor's EFT information in the correct manner, the Government remains responsible for--

- (i) Making a correct payment;
- (ii) Paying any prompt payment penalty due; and
- (iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and--

- (i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the contractor is responsible for recovery of any erroneously directed funds; or

- (ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (e) of this clause shall apply.

(h) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee register in the CCR database and be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(k) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Contractor has certified in accordance with paragraph (b) of this clause or if the Government otherwise makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of clause)

65 52.233-1 I DISPUTES (OCT 1995)--ALTERNATE I (DEC 1991)

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim -

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using -

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim

(iii) The certification shall state as follows:

"I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use ADR. If the Contractor refuses an offer for alternative disputes resolution, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph (d)(2)(iii) of this clause, and executed in accordance with subparagraph (d)(3) of this clause.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the contract, and comply with any decision of the Contracting Officer.

(End of clause)

#### 66 52.233-3 PROTEST AFTER AWARD (AUG 1996)

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or



(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

67 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed

in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

68      52. 236- 3              SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK  
(APR 1984)

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

(End of clause)

69      52. 236- 5              MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the

Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)  
(R 7-602.9 1964 JUN)

70      52. 236-6              SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

71      52. 236-7              PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

72      52. 236-8              OTHER CONTRACTS (APR 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

73      52. 236- 9      PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT,  
UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

74      52. 236- 10      OPERATIONS AND STORAGE AREAS (APR 1984)

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e. g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

75      52. 236- 11      USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)

(a) The Government shall have the right to take possession of or use any

completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

76      52. 236- 12      CLEANING UP (APR 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

77      52. 236- 13      ACCIDENT PREVENTION (NOV 1991)

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U. S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This

notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(End of clause)

78      52. 236- 14      AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

(R 7-603.30 1967 APR)

(R 7-2102.4 1976 OCT)

79      52. 236- 15      SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting

Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

80      52. 236- 21      SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval

thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

81      52. 236- 26      PRECONSTRUCTION CONFERENCE (FEB 1995)

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

82      52. 236- 7000      MODIFICATION PROPOSALS-- PRICE BREAKDOWN (DEC 1991)

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit an analysis of profit, and of all costs for--

- (i) Material;
- (ii) Labor;
- (iii) Equipment;
- (iv) Subcontracts; and
- (v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

(End of clause)



## 83      52. 242- 13      BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

## 84      52. 242- 14      SUSPENSION OF WORK (APR 1984)

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

## 85      52. 243- 4      CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials,

services, or site; or

(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

#### 86 52. 243- 7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

#### 87 52. 245- 1 PROPERTY RECORDS (APR 1984)

The Government shall maintain the Government's official property records in connection with Government property under this contract. The Government Property clause is hereby modified by deleting the requirement for the Contractor to maintain such records.

(End of clause)

(AV 7-104. 24(g) 1967 AUG)

#### 88 52. 245- 2 GOVERNMENT PROPERTY (FIXED- PRICE CONTRACTS) (DEC 1989)

(a) Government-furnished property. (1) The Government shall deliver to

the Contractor, for use in connection with and under the terms of this contract, the Government-furnished property described in the Schedule or specifications together with any related data and information that the Contractor may request and is reasonably required for the intended use of the property (hereinafter referred to as "Government-furnished property").

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) Changes in Government-furnished property. (1) The Contracting Officer may, by written notice, (i) decrease the Government-furnished property provided or to be provided under this contract, or (ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) above; or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) Title in Government property. (1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall Government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is

earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

(ii) Title to all other material shall pass to and vest in the Government upon--

(A) Issuance of the material for use in contract performance;

(B) Commencement of processing of the material or its use in contract performance; or

(C) Reimbursement of the cost of the material by the Government, whichever occurs first.

(d) Use of Government property. The Government property shall be used only for performing this contract, unless otherwise provided in this contract or approved by the Contracting Officer.

(e) Property administration. (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.

(2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.

(3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs within the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repair or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.

(f) Access. The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.

(g) Risk of loss. Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.

(h) Equitable adjustment. When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suit for breach of contract for--

(1) Any delay in delivery of Government-furnished property;

(2) Delivery of Government-furnished property in a condition not

suitable for its intended use;

(3) A decrease in or substitution of Government-furnished property; or

(4) Failure to repair or replace Government property for which the Government is responsible.

(i) Final accounting and disposition of Government property. Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, deliver f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.

(j) Abandonment and restoration of Contractor's premises. Unless otherwise provided herein, the Government--

(1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and

(2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) Communications. All communications under this clause shall be in writing.

(l) Overseas contracts. If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

#### 89 52. 245- 4 GOVERNMENT- FURNISHED PROPERTY (SHORT FORM) (APR 1984)

(a) The Government shall deliver to the Contractor, at the time and locations stated in this contract, the Government-furnished property described in the Schedule or specifications. If that property, suitable for its intended use, is not delivered to the Contractor, the Contracting Officer shall equitably adjust affected provisions of this contract in accordance with the Changes clause when--

(1) The Contractor submits a timely written request for an equitable adjustment; and

(2) The facts warrant an equitable adjustment.

(b) Title to Government-furnished property shall remain in the Government. The Contractor shall use the Government-furnished property only in connection with this contract. The Contractor shall maintain adequate property control records in accordance with sound industrial practice and will make such records available for Government inspection at all reasonable times, unless the clause at Federal Acquisition Regulation 52. 245- 1, Property Records, is included in this contract.

(c) Upon delivery of Government-furnished property to the Contractor, the

Contractor assumes the risk and responsibility for its loss or damage, except--

(1) For reasonable wear and tear;

(2) To the extent property is consumed in performing this contract;

or

(3) As otherwise provided for by the provisions of this contract.

(d) Upon completing this contract, the Contractor shall follow the instructions of the Contracting Officer regarding the disposition of all Government-furnished property not consumed in performing this contract or previously delivered to the Government. The Contractor shall prepare for shipment, deliver f.o.b. origin, or dispose of the Government property, as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as directed by the Contracting Officer.

(e) If this contract is to be performed outside the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

(R 7-104.24(f) 1964 NOV)

90 52.245-7001 REPORTS OF GOVERNMENT PROPERTY (MAY 1994)

(a) The Contractor shall provide an annual report--

(1) For all DoD property for which the Contractor is accountable under the contract;

(2) Prepared in accordance with the requirements of DD Form 1662, DoD Property in the Custody of Contractors, or approved substitute, including instructions on the reverse side of the form;

(3) In duplicate, to the cognizant Government property administrator, no later than October 31.

(b) The Contractor is responsible for reporting all Government property accountable to this contract, including that at subcontractor and alternate locations.

(End of clause)

91 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

92      52. 248- 3      VALUE ENGINEERING-- CONSTRUCTION (MAR 1989)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected

collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--

- (i) In deliverable end item quantities only; or
- (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

- (1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.
- (2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.
- (3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.
- (4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.
- (5) A prediction of any effects the proposed change would have on collateral costs to the agency.
- (6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.
- (7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action. (1) The Contracting Officer shall notify the



Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) Sharing. (1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

- (i) Accept the VECP;
- (ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and
- (iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the instant contract amount shall be increased by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings shall not exceed (1) the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or (2) \$100,000, whichever is greater. The Contracting Officer shall be the sole determiner of the amount of collateral savings, and that amount shall not be subject to the Disputes clause or otherwise subject to litigation under 41 U.S.C. 601-613.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on

the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract \_\_\_\_\_, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

93 52.248-7000 PREPARATION OF VALUE ENGINEERING CHANGE PROPOSALS  
(MAY 1994)

Prepare value engineering change proposals, for submission pursuant to the value engineering clause of this contract, in the format prescribed by the version of MIL-STD-973 in effect on the date of contract award.

(End of clause)

94 52.249-2 I TERMINATION FOR CONVENIENCE OF THE GOVERNMENT  
(FIXED-PRICE) (SEP 1996)-- ALTERNATE I (SEP 1996)

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.

(6) As directed by the Contracting Officer, transfer title and deliver

to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1 year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount.

Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(1) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

95      52. 249-10      DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if-

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the

public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

#### 96 52.249-5000 BASIS FOR SETTLEMENT OF PROPOSALS

Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a terminations settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

(End of Statement)

#### 97 52.252-4 ALTERATIONS IN CONTRACT (APR 1984)

Portions of this contract are altered as follows:

(End of clause)  
(R 7-105.1(a) 1949 JUL)

98      52. 253- 1      COMPUTER GENERATED FORMS (JAN 1991)

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, provided there is no change to the name, content, or sequence of the data elements on the form, and provided the form carries the Standard or Optional Form number and edition date.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition date.

(c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

END OF SECTION 00700

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## SPECIAL CLAUSES

### SC-1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984) (FAR 52.211-10).

The Contractor shall be required to (a) commence work under this Contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 510 calendar days after date of receipt by Contractor of notice to proceed. The time stated for completion shall include final cleanup of the premises.

#### SC-1.1 OPTION FOR INCREASED QUANTITY

a. The Government may increase the quantity of work awarded by exercising one or more of the Optional Bid Item(s) 0003, 0004 and 0005 at any time, or not at all, but no later than 180 calendar days after receipt by Contractor of notice to proceed. Notice to proceed on work Item(s) added by exercise of the option(s) will be given upon execution of consent of surety.

b. The parties hereto further agree that any option herein shall be considered to have been exercised at the time the Government deposits written notification to the Contractor in the mails.

c. The time allowed for completion of any optional items awarded under this contract will be the same as that for the base item(s), and will be measured from the date of receipt of the notice to proceed for the base item(s).

#### SC-1.2 EXCEPTION TO COMPLETION PERIOD(S)

In case the Contracting Officer determines that completion of seeding, sodding, and planting, and establishment of same is not feasible within the completion period stated above, the Contractor shall accomplish such work in the first planting period following the contract completion period and shall complete such work as specified, unless other planting periods are directed or approved by the Contracting Officer.

### SC-2. LIQUIDATED DAMAGES - CONSTRUCTION (APR 1984) (FAR 52.211-12)

(a) If the Contractor fails to complete the work within the time specified in the Contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \$1,000 for each day of delay.

(b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(d) Exception to Liquidated Damage: In case the Contracting Officer determines that completion of work stated above in paragraph Exception to Completion Period(s) is not feasible during the completion period(s) stated in SC-1, such work will be exempted from liquidated damages.

SC-3 DELETED – TIME EXTENSIONS (APR 1984) (FAR 52.211-13)

SC-4. DELETED - VARIATIONS IN ESTIMATED QUANTITIES - SUBDIVIDED ITEMS (MAR 1995) (EFARS 52.212-5001)

SC-5. INSURANCE - WORK ON A GOVERNMENT INSTALLATION (SEP 1989) (FAR 52.228-5)

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance period of this Contract at least the kinds and minimum amounts of insurance required in the Insurance Liability Schedule or elsewhere in the Contract.

(b) Before commencing work under this Contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective:

(1) for such period as the laws of the State in which this Contract is to be performed prescribe;  
or

(2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this Contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the Contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(d) Insurance Liability Schedule (FAR 28.307-2)

(1) Workers' compensation and employer's liability. Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when Contract operations are so commingled with a Contractor's commercial operation that it would not be practical to require this coverage. Employer's liability coverage of at least \$100,000 shall be required, except in states with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(2) General Liability.

(a) The Contracting Officer shall require bodily injury liability insurance coverage written on the comprehensive form of policy of at least \$500,000 per occurrence.

(b) Property damage liability insurance shall be required only in special circumstances as determined by the agency.

(3) Automobile liability. The Contracting Officer shall require automobile liability insurance written on the comprehensive form of policy. The policy shall provide for bodily injury and property damage liability covering the operation of all automobiles used in connection with performing the Contract. Policies covering automobiles operated in the United States shall provide coverage of at least \$200,000 per person and \$500,000 per occurrence for bodily injury and \$20,000 per occurrence for property damage. The amount of liability coverage on other policies shall be commensurate with any legal requirements of the locality and sufficient to meet normal and customary claims.

(4) Aircraft public and passenger liability. When aircraft are used in connection with performing the Contract, the Contracting Officer shall require aircraft public and passenger liability insurance. Coverage shall be at least \$200,000 per person and \$500,000 per occurrence for bodily injury, other than passenger liability, and \$200,000 per occurrence for property damage. Coverage for passenger liability bodily injury shall be at least \$200,000 multiplied by the number of seats or passengers, whichever is greater.

(5) Vessel liability. When Contract performance involves use of vessels, the Contracting Officer shall require, as determined by the agency, vessel collision liability and protection and indemnity liability insurance.

(6) Environmental Liability. If this contract includes the transport, treatment, storage, or disposal of hazardous material waste the following coverage is required.

The Contractor shall ensure the transporter and disposal facility have liability insurance in effect for claims arising out of the death or bodily injury and property damage from hazardous material/waste transport, treatment, storage and disposal, including vehicle liability and legal defense costs in the amount of \$1,000,000.00 as evidenced by a certificate of insurance for General, Automobile, and Environmental Liability Coverage. Proof of this insurance shall be provided to the Contracting Officer.

SC-6. DELETED - CONTINUING CONTRACTS (EFARS 52.232-5001) (MAR 1995):

SC-7. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) (FAR 52.236-1): The Contractor shall perform on the site, and with its own organization, work equivalent to at least 15 percent of the total amount of work to be performed under the Contract. The percentage may be reduced by a supplemental agreement to this Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SC-8. PHYSICAL DATA (APR 1984) (FAR 52.236-4): Data and information furnished or referred to below is for the Contractor's information. The Government will not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) Physical Conditions: The indications of physical conditions on the drawings and in the specifications are the result of site investigations by test holes shown on the drawings.

(b) Weather Conditions: Each bidder shall be satisfied before submitting his bid as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any National Weather Service Office.

(c) Transportation Facilities: Each bidder, before submitting his bid, shall make an investigation of the conditions of existing public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the jobsite. The unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of the work.

(d) Right-of-Way: The right-of-way for the work covered by these specifications will be furnished by the Government, except that the Contractor shall provide right-of-way for ingress and egress across private property where necessary to gain access to the jobsite. The Contractor may use such portions of the land within the right-of-way not otherwise occupied as may be designated by the Contracting Officer. The Contractor shall, without expense to the Government, and at any time during the progress of the work when space is needed within the right-of-way for any other purposes, promptly vacate and clean up any part of the grounds that have been allotted to, or have been in use by, him when directed to do so by the Contracting Officer. The Contractor shall keep the buildings and grounds in use by him at the site of the work in an orderly and sanitary condition. Should the Contractor require additional working space or lands for material yards, job offices, or other purposes, he shall obtain such additional lands or easements at his expense.

(e) Condition of Area: The condition of the area when last surveyed is shown on the drawings. Topography is in feet and represents elevation with reference to mean lower low water (M.L.L.W.).

(f) Obstruction of Channel: The Government will not undertake to keep the channel free from vessels or other obstructions, except to the extent of such regulations, if any, as may be prescribed by the Secretary of the Army, in accordance with the provisions of Section 7 of the Rivers and Harbors Act approved 8 August 1917. The Contractor will be required to conduct the work in such manner as to obstruct navigation as little as possible, and in case the Contractor's plant so obstructs the channel as to make difficult or endanger the passage of vessels, said plant shall be promptly moved on the approach of any vessel to such an extent as may be necessary to afford a practicable passage. Upon the completion of the work, the Contractor shall promptly remove his plant, including ranges, buoys, piles, and other marks placed by him under the Contract in navigable waters or on shore.

(g) Datum and Bench Marks: The plane of reference of M.L.L.W. as used in these specifications is that determined by the bench marks, as shown on the drawings.

SC-9. DELETED - QUANTITY SURVEYS (APR 1984) (FAR 52.236-16)

SC-10. LAYOUT OF WORK (APR 1984) (FAR 52.236-17): The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before

their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due, or to become due, to the Contractor.

SC-11. DELETED - PAYMENT FOR MOBILIZATION AND DEMOBILIZATION (DEC 1991) (FAR 52.236-7004)

SC-12. DELETED - AIRFIELD SAFETY PRECAUTIONS (DEC 1991) (DOD FAR SUPP 252.236-7005)

SC-13. IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984) (FAR 52.245-3):

(a) The Government will furnish to the Contractor the property identified in the schedule to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished to the Contractor at the place designated by the Contracting Officer. The Contractor is required to accept delivery, pay any demurrage or detention charges, and unload and transport the property to the jobsite at its own expense. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting Officer within 24 hours of delivery any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract. Delivery site location for Government Furnished Property is at construction site.

(b) For purposes of calculating the amount of Washington State Use Tax to be included in his bid; the Contractor shall use an estimated value of \$400 for Government-furnished Contractor-installed (GF/CI) equipment/property. Ultimately the actual cost of equipment furnished will be used to adjust the final contract amount by modification to reflect the user tax excluding Contractor markups, actually paid by the Contractor for GF/CI equipment schedule.

#### **SCHEDULE**

<b>QUANTITY</b>	<b>ITEM</b>	<b>DESCRIPTION</b>	<b>VALUE (TOTAL)</b>
2	--	PLAQUE	\$400

SC-14. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) (EFARS 52.231-5000)

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense

Schedule, Region VIII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(e) Copies of EP1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" Volume 4 (Montana) and Volume 8 (Washington, Oregon and Idaho) are available from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954, phone (202) 512-1800 and fax (202) 512-2250, OR from the Government Bookstore in the Jackson Federal Building, Seattle, WA, phone (206) 553-4279. The cost is \$33.00 for each volume. Use the following stock numbers when ordering schedules:

S/N 008-022-00317-7

Volume 4

S/N 008-022-00321-5

Volume 8

#### SC-15. PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAR 1995) (EFARS 52.232-5000)

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: Any other construction material stored offsite may be considered in determining the amount of a progress payment.

#### SC-16. DELETED - ORDER OF PRECEDENCE

#### SC-17. DELETED - LIMITATION OF PAYMENT FOR DESIGN



SC-18. CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (OCT 1996) (52.0236-4001 EBS)

(a) The Government--

(1) will provide the Contractor, without charge, one set of contract drawings and one set of specifications in electronic format on a compact disk. The Government will not give the Contractor any hard copy paper drawings or specifications for any contract resulting from this solicitation.

(b) The Contractor shall--

(1) check all drawings furnished immediately upon receipt;

(2) compare all drawings and verify the figures before laying out the work;

(3) promptly notify the Contracting Officer of any discrepancies;

and

(4) be responsible for any errors which might have been avoided by complying with this paragraph (b).

(c) Large scale drawings shall, in general, govern small scale drawings. Figures marked on drawings shall, in general, be followed in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in the index of drawings attached at the end of the Special Clauses.

SC-19. DELETED - TECHNICAL PROPOSAL - COPIES TO BE FURNISHED UPON AWARD

SC-20. DELETED - COMPLIANCE CERTIFICATION

SC-21. DELETED - VALUE ENGINEERING

SC-22. EPA ENERGY STAR: The Government requires that certain equipment be Energy Star compliant. Initially, the sole Energy Star requirement shall be the self-certification by the bidder that the specified equipment is Energy Star compliant. Within 3 months of the availability of an EPA sanctioned test for Energy Star compliance, the Contractor shall submit all equipment upgrades and additions for testing and provide proof of compliance to the Government upon completion of testing. Testing shall be at the Contractor's expense.

SC-23. YEAR 2000 COMPLIANCE:

(a) In accordance with FAR 39.106, the Contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically:

(b) The Contractor shall:

(1) Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order which may be affected by the Year 2000 compliance requirement.

(2) Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to Government acceptance.

SC-24. RECOVERED MATERIALS: The Corps of Engineers encourages all bidders to utilize recovered materials to the maximum extent practicable. The attached APPENDIX R contains procurement guidelines for products containing recovered materials.

## APPENDIX R

### PART 247 - COMPREHENSIVE PROCUREMENT GUIDELINE FOR PRODUCTS CONTAINING RECOVERED MATERIALS

40 CFR Ch. 1 (7-7-96 Edition)

#### Subpart B-Item Designations

##### § 247.10 Paper and paper products.

Paper and paper products, excluding building and construction paper grades.

##### § 247.11 Vehicular products.

- (a) Lubricating oils containing refined oil, including engine lubricating oils, hydraulic fluids, and gear oils, excluding marine and aviation oils.
- (b) Tires, excluding airplane tire
- (e) Reclaimed engine coolants, excluding coolants used in non-vehicular applications.

##### § 247.12 Construction products.

- (a) Building insulation product including the following items:
  - (1) Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock vermiculite, and perlite;
  - (2) Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool);
  - (3) Board (sheathing, roof decking wall panel) insulation, including but not limited to structural fiber and laminated paperboard products perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and
  - (4) Spray-in-place insulation, including but not limited to foam-in polyurethane and polyisocyanurate and spray-on cellulose.
- (b) Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing shingle backer, sound deadening roof insulating board, insulating board, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels underlayments, and roof overlay (coverboard).
- (c) Cement and concrete, including concrete products such as pipe block, containing coal fly as ground granulated blast furnace (GGBF) slag.
- (d) Carpet made of polyester fiber use in low- and medium-wear applications.
- (e) Floor tiles and patio block containing recovered rubber or plastic.

##### §247.13 Transportation products.

Traffic barricades and traffic used in controlling or restricting vehicular traffic.

##### § 247.14 Park and recreation products

Playground surfaces and running tracks containing recovered rubber or plastic.

§ 247.15 Landscaping products.

(a) Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and over-spray for straw mulch in landscaping, erosion control, and soil reclamation.

(b) Compost made from yard trimmings, leaves, and/or grass clippings for use in landscaping, seeding of or other plants on roadsides and embankments, as a nutritious under trees and shrubs, and in erosion control and soil reclamation.

§ 247.16 Non-paper office product.

(a) Office recycling containers and office waste receptacles.

(b) Plastic desktop accessories.

(c) Toner cartridges.

(d) Binders.

(e) Plastic trash bags.

## INDEX OF DRAWINGS

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F/171-40-35	2	Index	Drawing Index, Symbols, Abbreviations		1 FEB 99
F/171-40-35	3	LS 1.1	Building Code Analysis		1 FEB 99
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### MODIFICATIONS TO CONTRACT DRAWINGS

- Sheet 8, Plate C3.3 and Sheet 9, Plate C3.4, Detail D: Provide rock wall per “Rock Wall Section”, sketch attached at end of this section.
- Sheet 20, Plate A1.1: The reference to the refrigerator/freezer indicates that is part of the contract both for furnishing and installation.
- Sheet 21, Plate A2.1, Add chair rail to Class Rooms #257 and #258.
- Sheet 22, Plate A2.3, Add a plaster soffit to the exterior porch area east of door 162A. Plaster soffit to stop at back of brick lintel. Contractor’s option to use metal soffit panel used on overhang at windows in lieu of plaster at this soffit.
- Sheet 28, Plate A5.1, Wall Sections: References to Window Head Details are to be 1/A7.2.
- Sheet 31, Plate A6.1, Door Schedule:
  - Door 101A Hardware Set to be changed to Set #17. This door is incorrectly indicated on Sheet 20, Plate A1.1 as 114A. It is located on the east wall of the Assembly Hall at the midway point and changed to 101A.
  - Door 114B Hardware Set to be changed to Set #17.
  - Door 114C Hardware Set to be changed to Set #17.
  - Door 117A Hardware Set to be changed to Set #8 and is to be a ‘C’ Label door.
  - Door 134A Hardware Set to be changed to Set #8 and is to be a ‘C’ Label door.
  - Door 149A Hardware Set to be changed to Set #14.
  - Door 162A, Add Head Detail 23.
  - Door 163A is to be changed to PR 6’-0” x 7’-0” Opening Size, Door Type ‘D’, Frame Elev ‘DNG’, Jamb Detail 2, Hardware Set #16.
  - Door 164A Hardware Set to be changed to Set #15.
  - Door 167A Hardware Set to be changed to #1, with no Label on the door.
  - Door 178A Opening Size to be changed to 3’-0” x 7’-0”, with no Label on the door.
  - Door 177A Hardware Set to be changed to Set #1.
  - Door 179A Hardware Set to be changed to Set #1.
  - Door 180A Hardware Set to be changed to Set #2.
  - Door 183A Hardware Set to be changed to Set #1.
  - Door 184B Hardware Set to be changed to Set #2.
  - Doors 190A and 192A are juxtaposed to each other and are to read:
    - Door Mark 190A, Opening Size 3’-0” x 7’-0”, Door Type A, Frame Elev DNG,
    - Jamb Detail 2, Hardware Set 1.
    - Door Mark 192A, Opening Size 3’-0” x 7’-0”, Door Type A, Frame Elev DNG,
    - Jamb Detail 2, Hardware Set 1.
  - Add Door Mark 328A, Opening Size 3’-0” x 7’-0”, Label ‘C’, Door Type A, Frame Elev DNG,
  - Jamb Detail 2, Hardware Set 8.

Transition Strips are only applicable when transitioning to differing flooring materials.

- Sheet 34, Plate A7.1, Window Types: All references to head detail 6 are to be replaced with, detail 1.
- Sheet 40, Plate A9.2, Detail 153: Add the following note: “The 18 ga. horizontal sheet metal strip is to occur a three separate heights. Provide one 6” above floor, one at top of furniture partition, and one equidistant between the top and bottom strips, or as otherwise directed by furniture manufacturer.
- Detail 225: Reference to Details 201 thru 204/A9 is to say “Similar”.



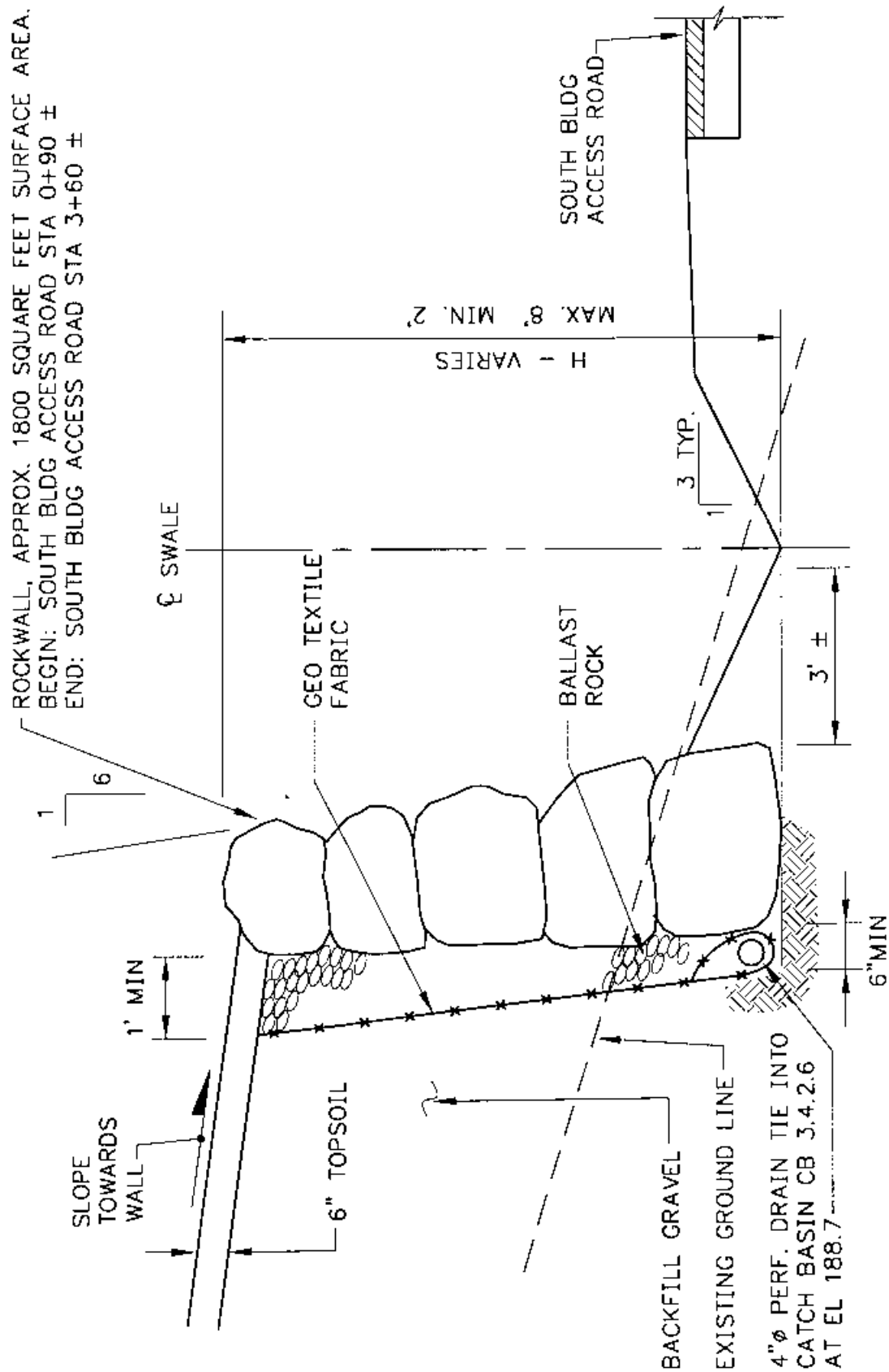
- Sheet 41, Plate A9.3, Detail 204: Replace references to counter top of plastic laminate to “solid polymer”. Vanities and counter tops in Break Room and Medical Room are to be solid polymer.
- Sheet 41, Plate A9.3, Detail 591: 6” legs are to be changed to 4” high steel base (with end closures) capable of supporting lockers. The 13” dimension is to be replaced with “As Specified”.
- Sheet 45, Plate A11.3, Detail 5: “(3)-18” Deep Shelving” indicates the combination of (3) complete shelving units as specified in Section 10552 to make up the required length as noted on plans.
- Sheet 46, Plate A12.1, Medical Room #147 to have SS-2 Countertops in lieu of that indicated. Photo Lab, Room #153 to have Stainless Steel Countertops with casework indicated in Specifications Section 11470.
- Sheet 47, Plate A14.1, Signage Details:
  - Delete all references to Exterior Horizontal Pylon Sign.
  - Add sign Type 2. Sign Type 2 to be 7 ½”, vinyl applied helvetica medium letters applied to the center of the exterior face of the door stating: “United States Army Reserve Center”.
- Sheet 56, Plate S1.1, Foundation and Ground Floor Plan: “W18, W24, W30, etc.” refer to wall footings on the Wall Footing Schedule located on S0.1.
- Sheet 57, Plate S2.1, Second Floor Low Roof Framing:
  - Note 11 is the detail reference call out for details 4, 5, 6, 7, & 8 on sheet S4.2.
  - Revise the floor framing as shown on the attached SK-02/S2.1.
- Sheet 58, Plate S3.1: To be revised as indicated with attached SK-02/S3.1
- Sheet 61, Plate S5.1, Detail 15: Plate thickness for F66, F72, and F78 is to be 5/8” in lieu of that indicated.
- Sheet 64, Plate S5.4: Add attached details SK-02/S5.4 and SK-02B/S5.4.
- Sheet 106, Plate E2.1, Second Floor Lighting Plan Part A: “EC” is a detail reference to Detail #504. It has (4) four 32 watt lamps, 277 volts, (2) two lamp dimming ballasts.

#### STANDARD DETAILS BOUND IN THE SPECIFICATIONS

DRAWING NUMBER	SHEET NUMBER	TITLE	DATE
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#### SECTION 01501 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

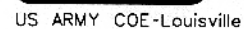
1 & 2	U.S. Army Project Construction Sign	84JUN20
1	Hard Hat Sign	10SEP90

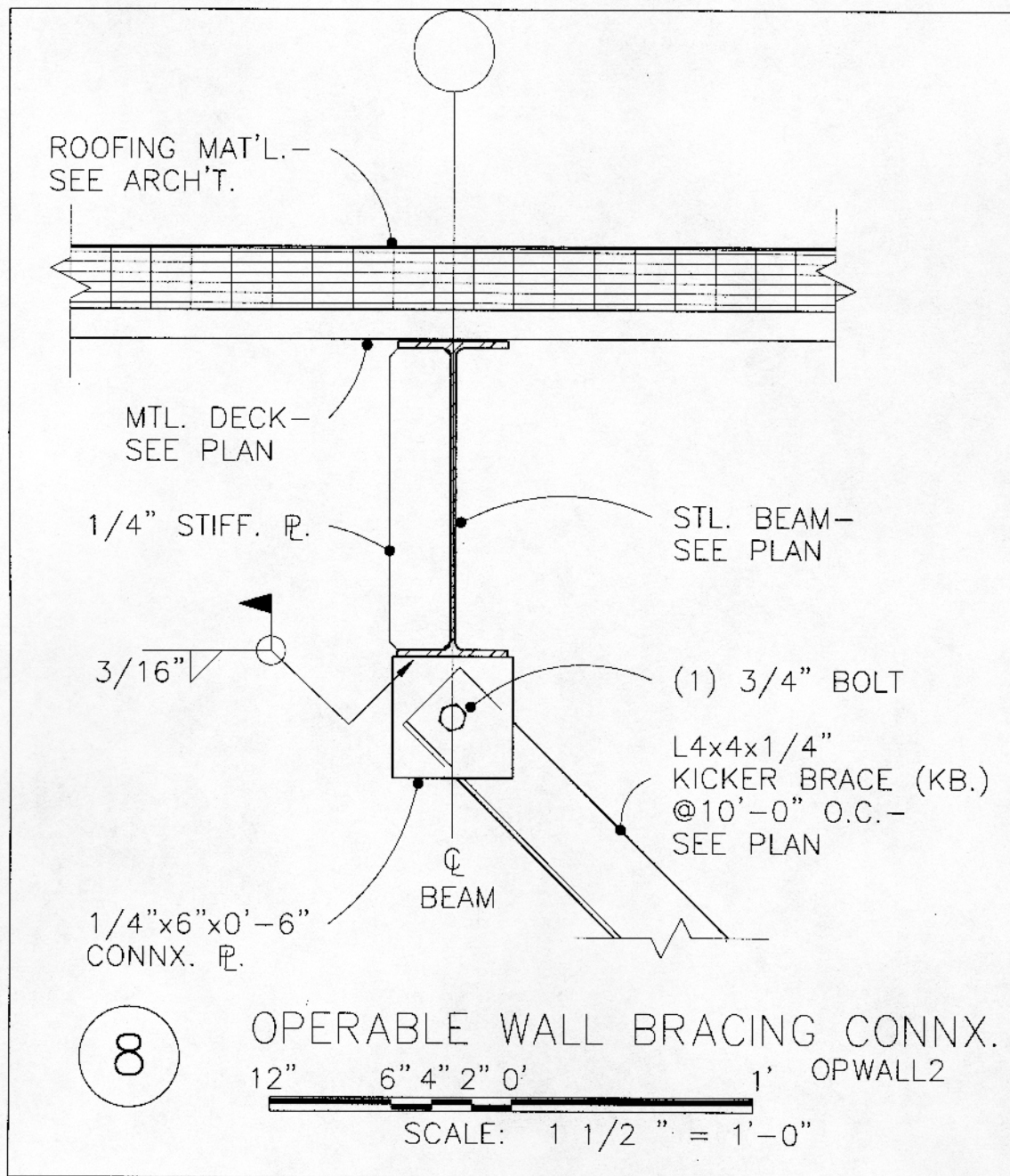


# ROCK WALL SECTION

NTS







PROJ NUMBER : MCAE PN 10008B

FISCAL YEAR : 1998

DRAWING CODE : F-171-40-35

DATE : 26 May 98

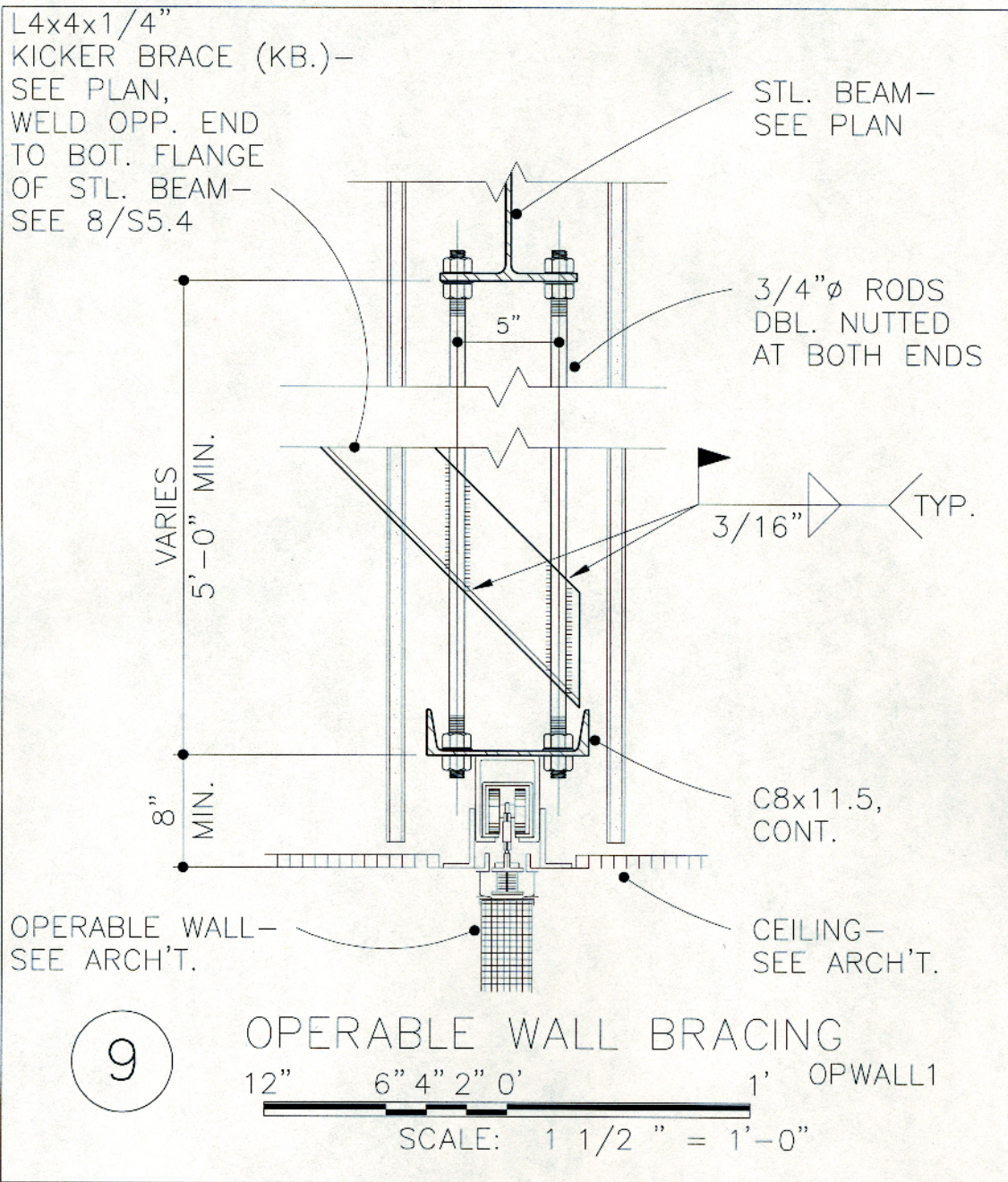
SK-02/S5.4

**USARC/OMS - Phase Two**  
**Ft. Lawton, Washington**



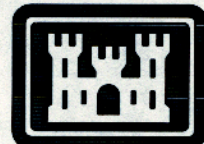
US ARMY COE-Louisville





PROJ NUMBER : MCAR PN 10008B  
FISCAL YEAR : 1998  
DRAWING CODE : F-171-40-35  
DATE : 26 May 98  
**SK-02B/S5.4**

**USARC/OMS - Phase Two**  
**Ft. Lawton, Washington**



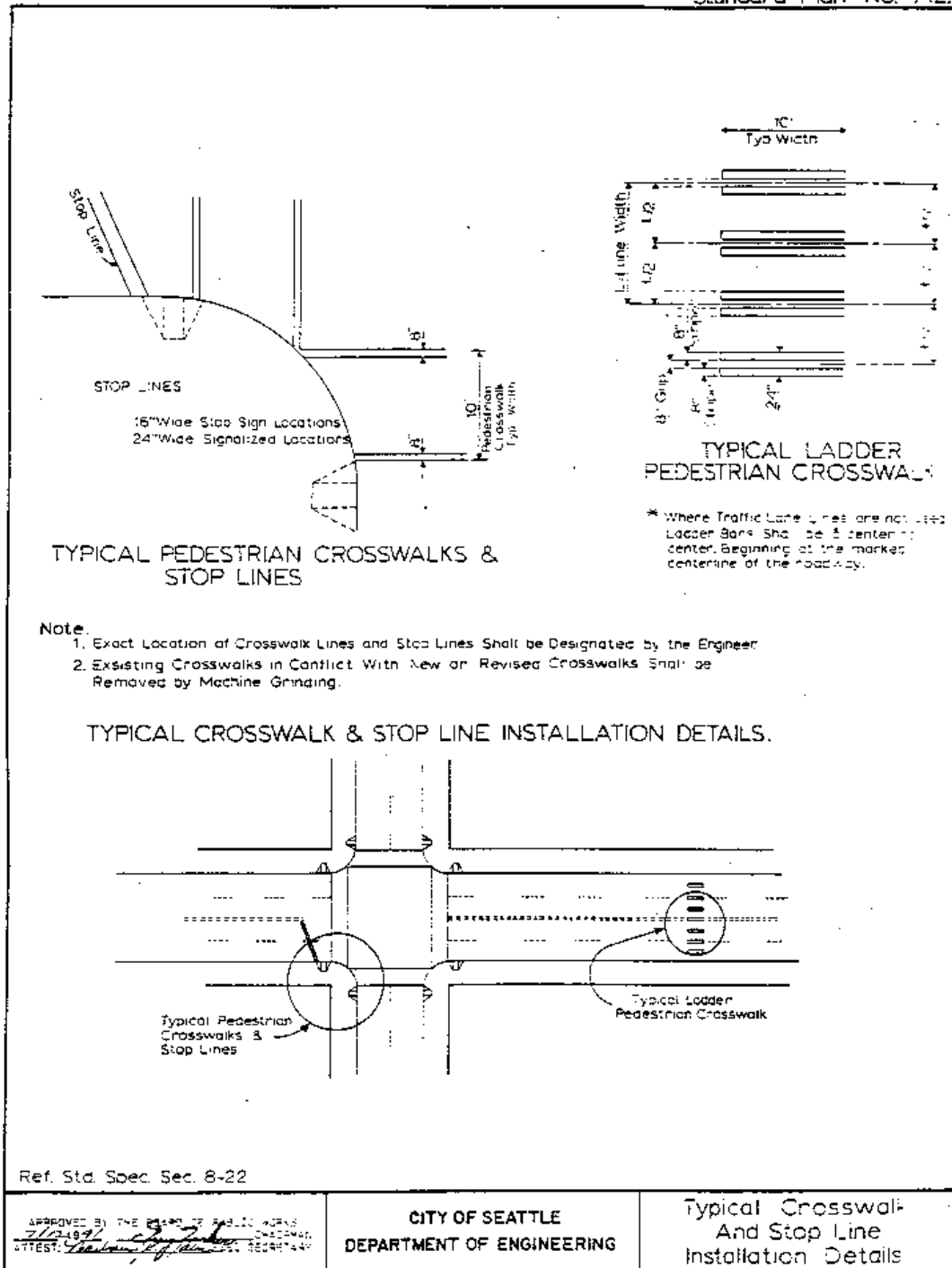
US ARMY COE-Louisville

SECTION 00850  
STANDARD DETAILS  
INDEX

WATER MAIN CONNECTIONS, HYDRANTS, AND DETAILS	00850-2 to 00850-9
CURB AND SIDEWALK DETAILS	00850-10 to 00850-12
PAVEMENT MARKINGS	00850-13 to 00850-16
CATCH BASINS AND GRATES	00850-17 to 00850-20



Standard Plan No. 7121

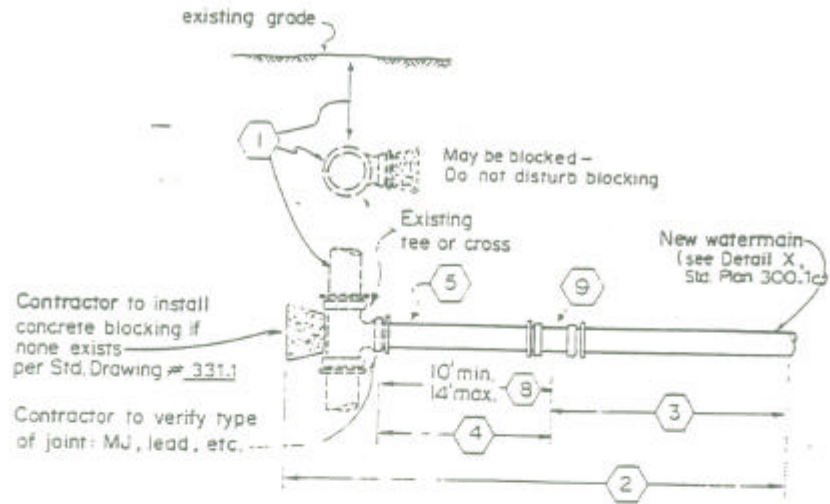


27

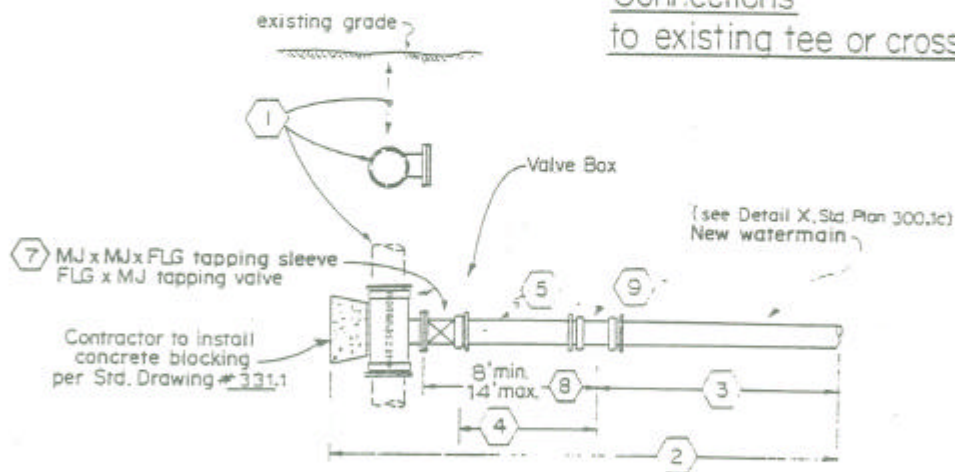
00350-16



Standard Plan No. 300.1a



### Connections to existing tee or cross



### Connections to existing main, no tee or cross (tapping sleeve & tapping valve)

For Legend and Notes See Standard Plan No. 300.1c  
Ref. Std. Spec. Sec. 7-11

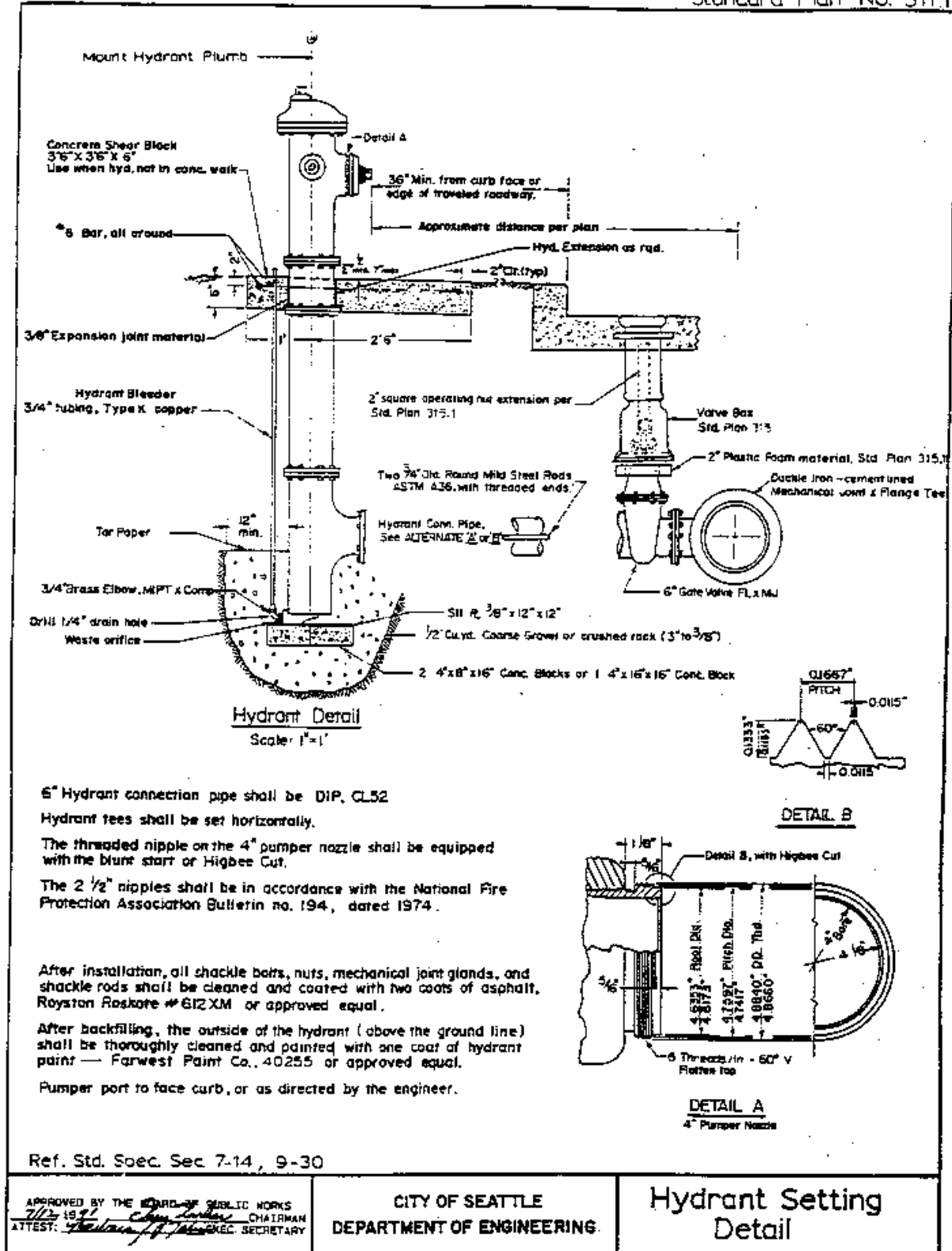
Do Not Scale

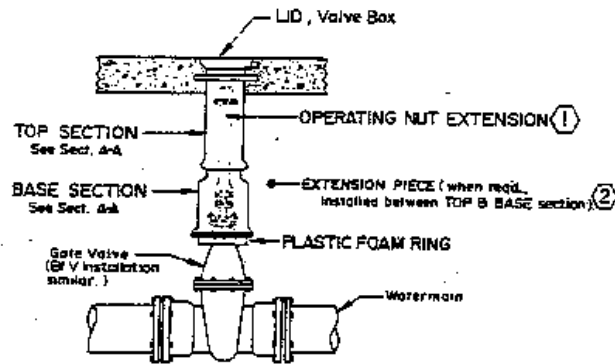
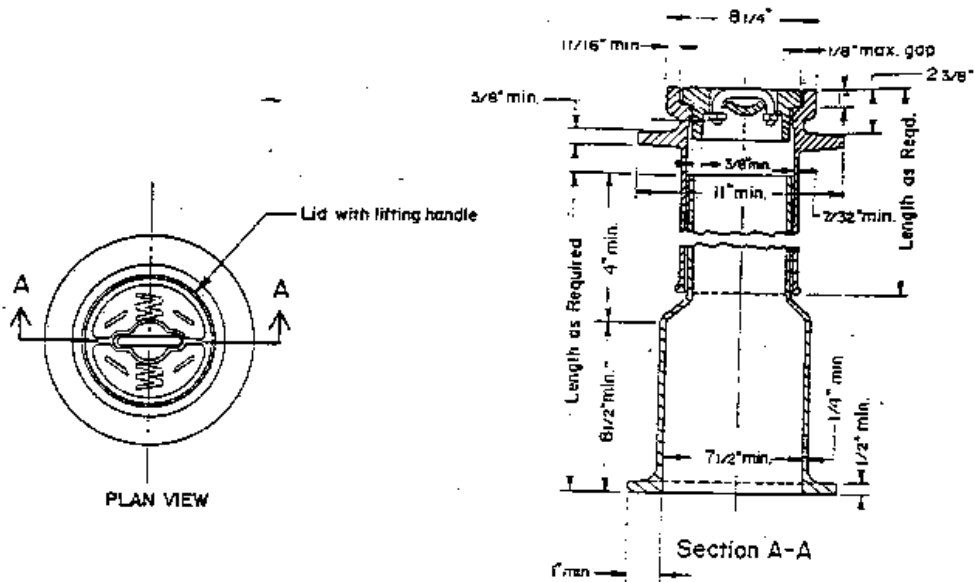
APPROVED BY THE BOARD OF PUBLIC WORKS  
7/12/19 71  
ATTEST: *Chairman* CHAIRMAN  
*Secretary* SECRETARY

CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Connections to  
Existing Watermains

Standard Plan No. 311.1a





VALVE BOX ASSY.,  
TYPICAL SETTING DETAIL

For Legend and Notes See Std. Plan 315.1b  
Ref. Std. Spec. Sec. 7-12, 9-30

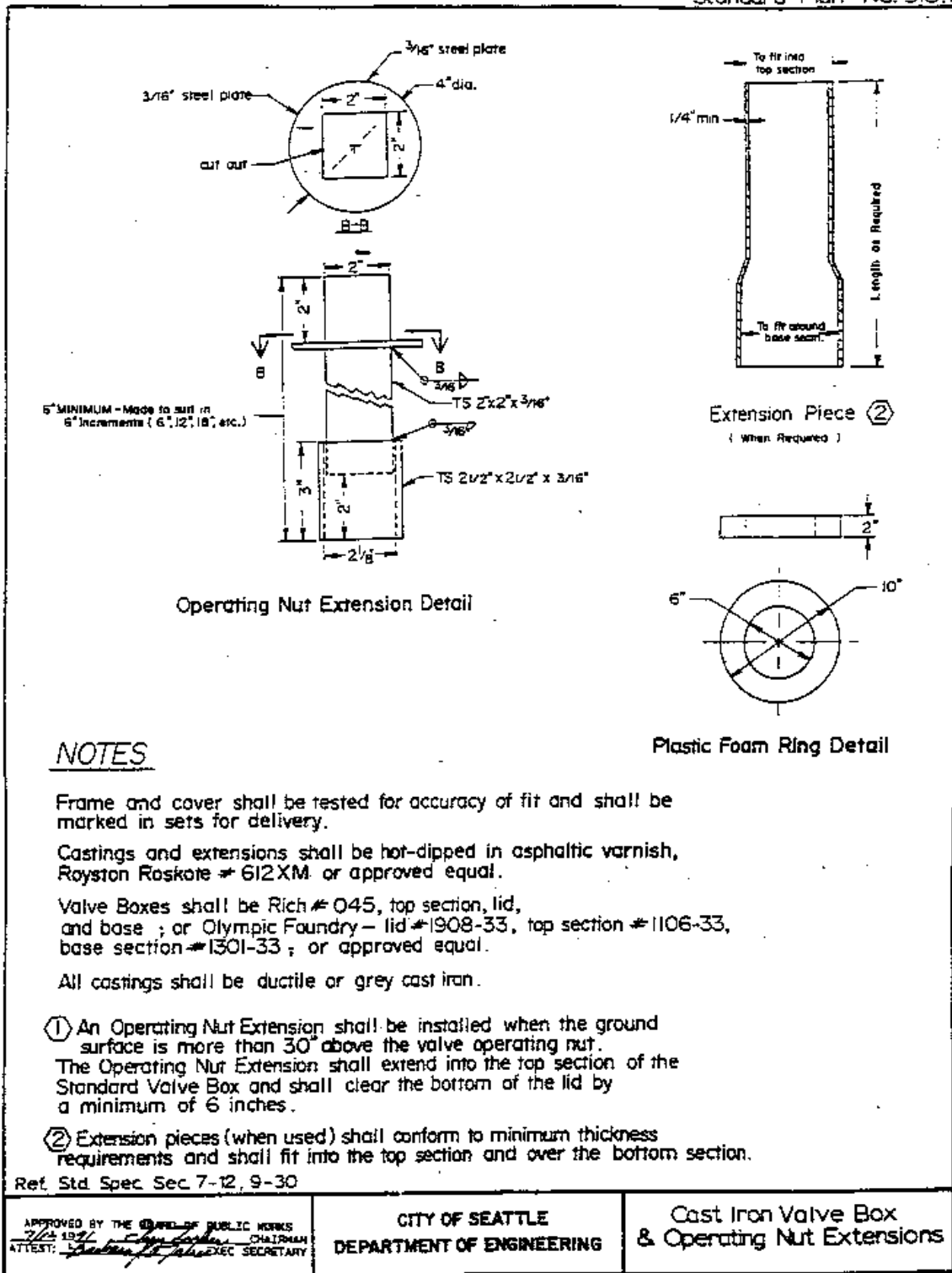
Do Not Scale

<p>APPROVED BY THE BOARD OF PUBLIC WORKS 7/12/91 <i>Chas. L. Jones</i> CHAIRMAN ATTEST: <i>John P. Jones</i> SEC. SECRETARY</p>	<p>CITY OF SEATTLE DEPARTMENT OF ENGINEERING</p>	<p>Cast Iron Valve Box &amp; Operating Nut Extensions</p>
---	--	---

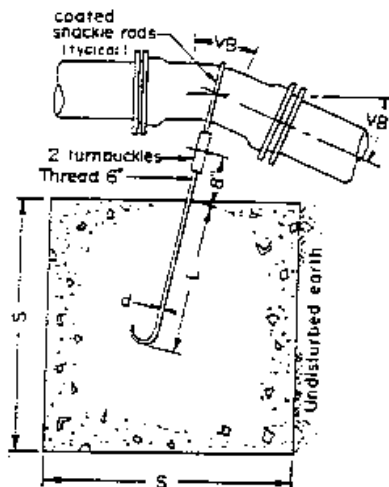
108

00850-5

Standard Plan No. 315.1b

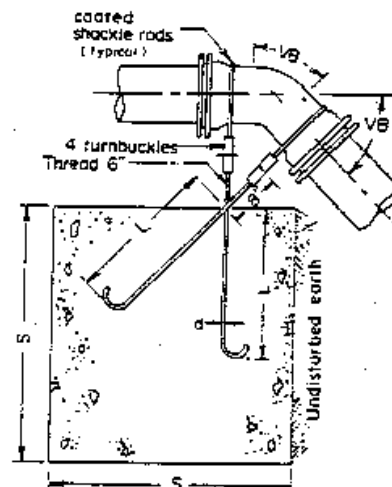


Standard Plan No. 330.1a



Type A  
No Scale

TYPE "A" BLOCKING for 11 1/2° & 22 1/2° Vertical Bends						
Pipe size Nom Diameter-inches	Test Pressure psi	Vertical Bend Degrees	No. of cu ft of Conc. Blocking	Side of Cube feet	Diameter of Shackle Rods/2 inches	Depth of Rods in Concrete inches
4"	300	11 1/2°	8	2	3/8"	18
		22 1/2°	12	2 1/4	3/8"	24
6"	300	11 1/2°	12	2 1/4	3/8"	24
		22 1/2°	27	3	3/8"	24
8"	300	11 1/2°	16	1 2 1/2	3/8"	24
		22 1/2°	43	3 1/2	3/8"	24
12"	300	11 1/2°	64	4	3/4"	24
		22 1/2°	125	5	7/8"	36



Type B  
No Scale

TYPE "B" BLOCKING for 45° Vertical Bends						
Pipe size Nom Diameter-inches	Test Pressure psi	Vertical Bend Degrees	No. of cu ft of Conc. Blocking	Side of Cube feet	Diameter of Shackle Rods/2 inches	Depth of Rods in Concrete inches
4"	300	45°	27	3	3/8"	20
			64	4	3/8"	20
6"	300	45°	125	5	3/8"	30
			216	6	7/8"	30

For Notes See Standard Plan 330.1b

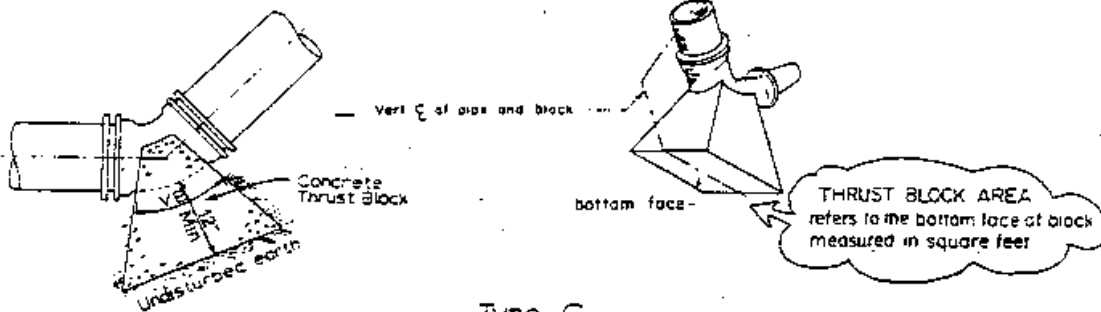
Ref. Std. Spec. Sec. 7-11

APPROVED BY THE BOARD OF PUBLIC WORKS  
7/12/1976  
ATTEST: *[Signature]* CHAIRMAN  
*[Signature]* SECRETARY

CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Watermain Thrust Blocking  
Vertical Fittings

Standard Plan No. 330.1b



Type C  
No Scale

TYPE "C" BLOCKING for 1 1/4", 2 1/2", 45° and 90° Vertical Bends									
THRUST BLOCK AREA IN SQUARE FEET									
SOIL	Firm silt or firm silty sand			Compact Sand			Compact Sand & Gravel		
FITTING	90° Bend	Tee 45° bend and Dead End	1 1/4" and 2 1/2" bend	90° Bend	Tee 45° bend and Dead End	1 1/4" and 2 1/2" bend	90° Bend	Tee 45° bend and Dead End	1 1/4" and 2 1/2" bend
PIPE SIZE									
4"	5.8	4.2	1.7	2.9	2.1	1.0	2.2	1.6	1.0
6"	13.3	9.4	3.8	6.7	4.7	1.9	5.0	3.5	1.4
8"	23.3	16.7	6.7	11.7	8.4	3.4	8.8	6.3	2.5
12"	53.0	37.5	15.0	26.5	18.8	7.5	20.0	14.0	5.6

Areas calculated on 300psi test pressure and 36" min. cover over w.m.

w.m. = Watermain

### Notes

Location and size of blocking for pipe larger than 12" and for soil types different than shown shall be determined by the engineer.

All blocking for vertical fittings (poured in place) shall bear against undisturbed native ground.

All poured Thrust Blocks shall be in place and sufficient time shall be allowed for the concrete to cure and trench shall be backfilled and compacted prior to pressure testing.

All blocking to be concrete C15 (1-1/2).

After installation, shackle rods & turnbuckles shall be cleaned and coated with 2 coats of asphaltic varnish, Royston Royston #612XM or approved equal.

Shackle rods shall be round mild steel, ASTM A-36 with threads on ends only.

Blocking against fittings shall bear against the greatest fitting surface area possible, but shall not cover or enclose bell ends, joint bolts or glands.

Ref. Std. Spec. Sec. 7-11

APPROVED BY THE BOARD OF PUBLIC WORKS  
7/12/1976 *John J. [Signature]* CHAIRMAN  
ATTEST: *[Signature]* SECRETARY

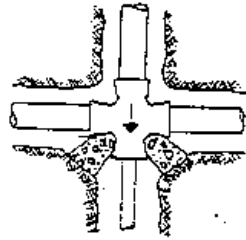
CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Watermain Thrust Blocking  
Vertical Fittings

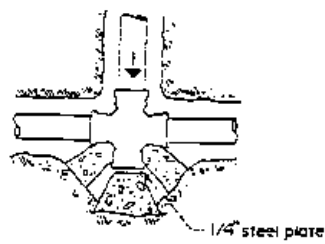
111

00850-9

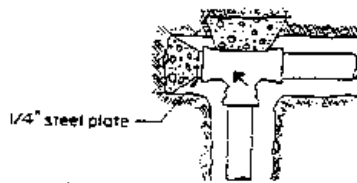
Standard Plan No. 331.1a



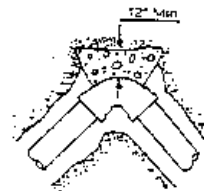
Unbalanced Cross



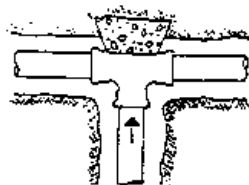
Cross with Plug



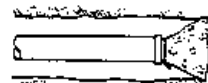
Plugged Tee



Horizontal Bend




Tee



Pipe & Cap

PIPE SIZE	THRUST BLOCK AREA IN SQUARE FEET (See Standard Plan No. 331b)									
	Firm silt or firm silty sand			Compact Sand			Compact Sand & Gravel			
	90° Bend	TEE, 45° bend, cap or plug	11 1/4" and 22 1/2" bend	90° Bend	TEE, 45° bend, cap or plug	11 1/4" and 22 1/2" bend	90° Bend	TEE, 45° bend, cap or plug	11 1/4" and 22 1/2" bend	
4"	7.0	4.2	1.7	2.9	1.2	1.0	2.2	1.6	1.0	
6"	13.3	9.4	3.8	6.7	4.7	1.9	5.0	3.5	1.4	
8"	23.3	16.7	6.7	11.7	8.4	3.4	8.8	6.3	2.5	
12"	53.0	37.5	15.0	26.5	18.8	7.5	20.0	14.0	5.6	

Areas calculated on 300psi test pressure and 36" min. cover over w.m.

 Ecology Blocks, per Standard Plan 460 may be used in lieu of poured-in-place blocking for fittings in shaded portion of table.

For Notes See Standard Plan 331b

Ref. Std. Spec. 7-11

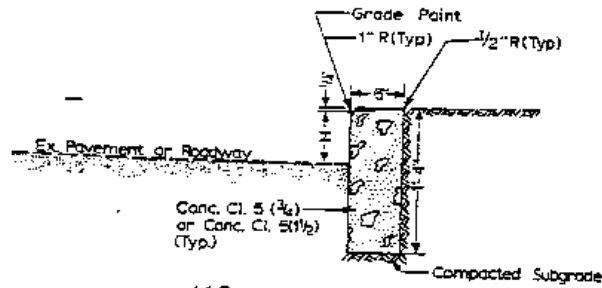
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APPROVED BY THE BOARD OF PUBLIC WORKS  
7/12/1991  
ATTEST: *[Signature]* CHAIRMAN  
*[Signature]* EXEC. SECRETARY

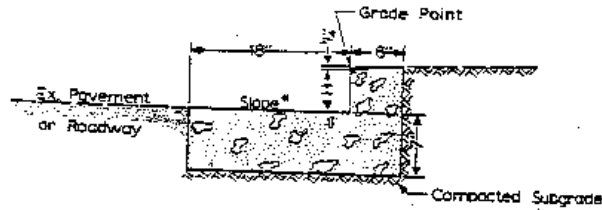
CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Watermain Thrust Blocking  
Horizontal Fittings

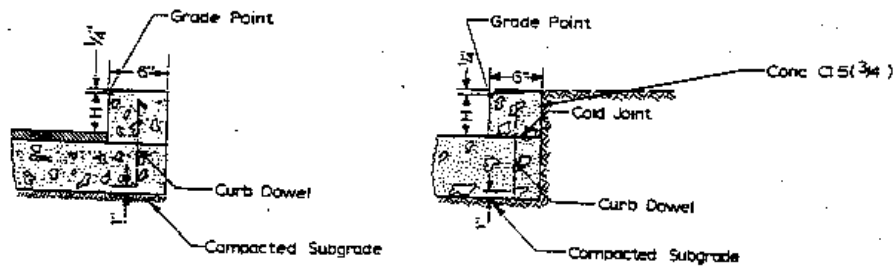
Standard Plan No. 410



410 A Curb



410 B-Curb and Gutter



410 C Curb

"H" shall be 6" from finished roadway grade unless otherwise specified.

For Type 410A Curb, install 1/2" Through Joints full depth to match joints of existing pavement.

\*Gutter shall be sloped the same as adjacent pavement or 2% min, whichever is greater.

See Std. Plan No. 411 for Curb Dowels.

Do Not Scale

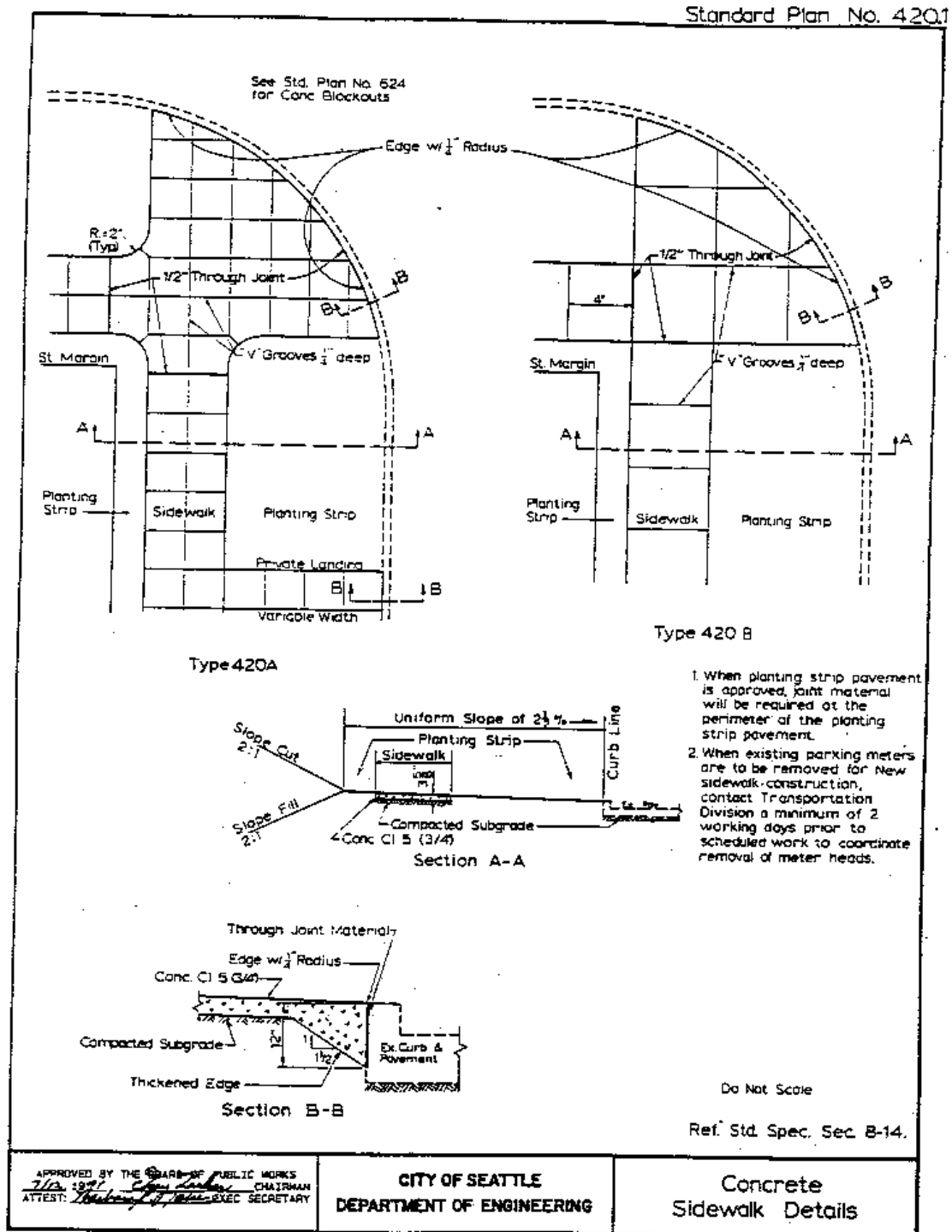
Ref. Std. Spec. Sec. 8-04.

<p>APPROVED BY THE BOARD OF PUBLIC WORKS 10/31/84 ATTEST: <i>[Signature]</i> CHAIRMAN <i>[Signature]</i> SECRETARY</p>	<p>CITY OF SEATTLE DEPARTMENT OF ENGINEERING</p>	<p>Type 410 Curb</p>
--	--	----------------------

128

00850-10

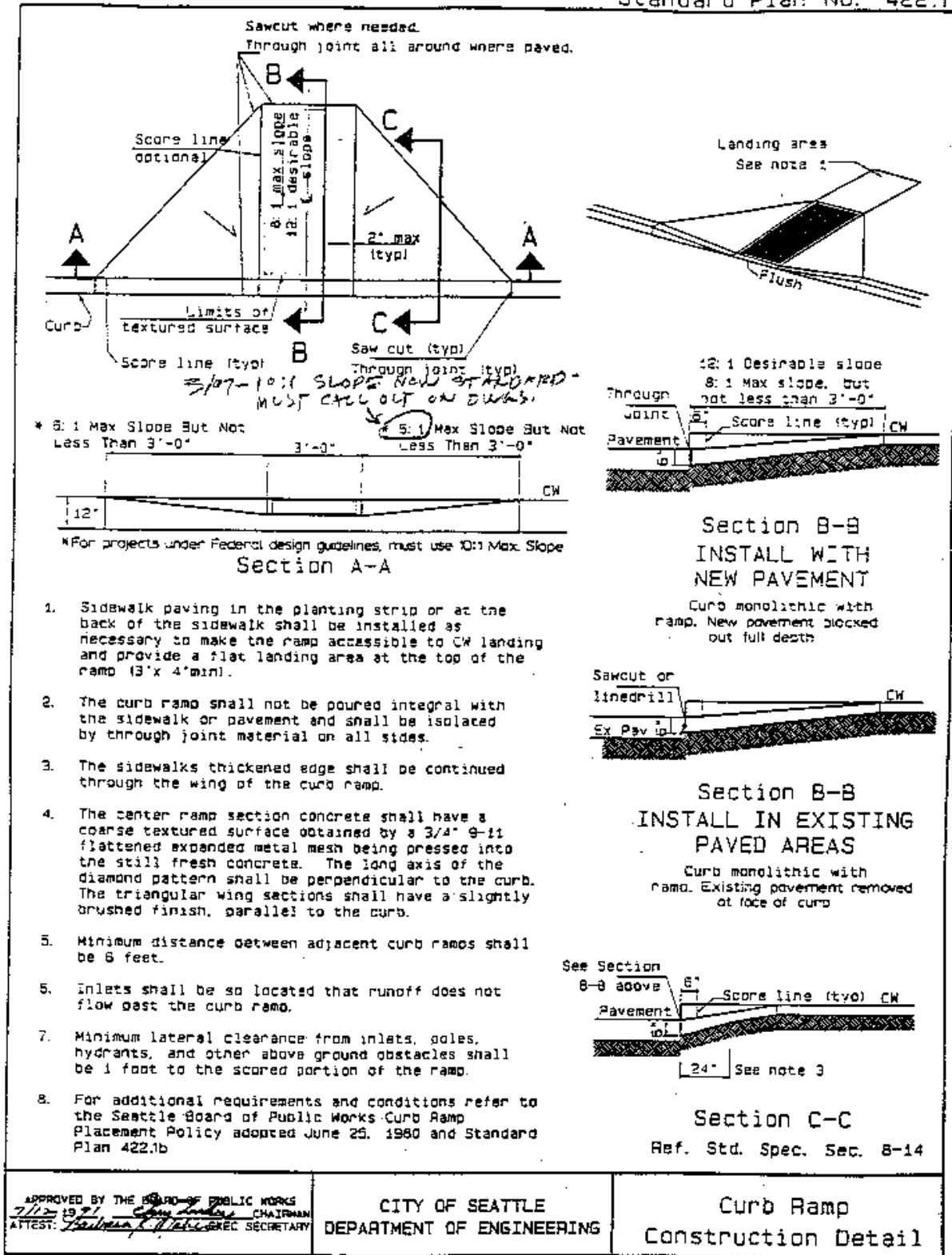




134

00850-11

Standard Plan No. 422.1c

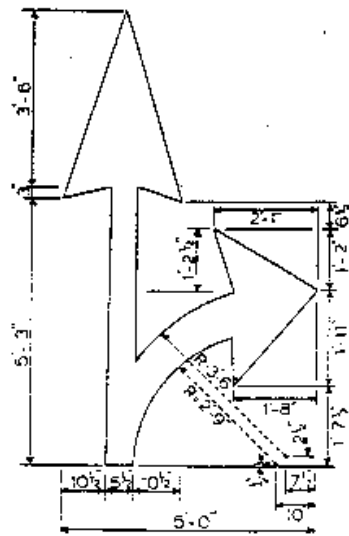


136

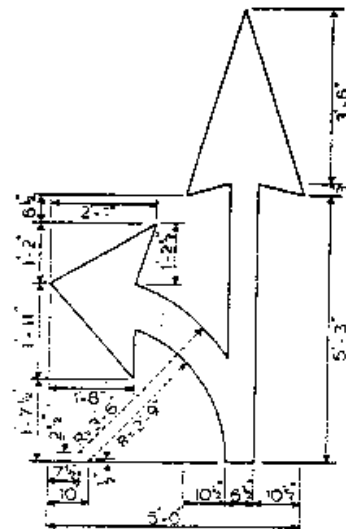
00850-12

00850-13

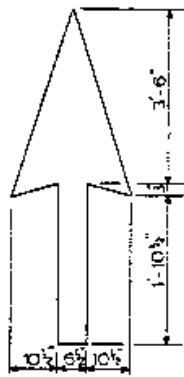
Standard Plan No. 720b



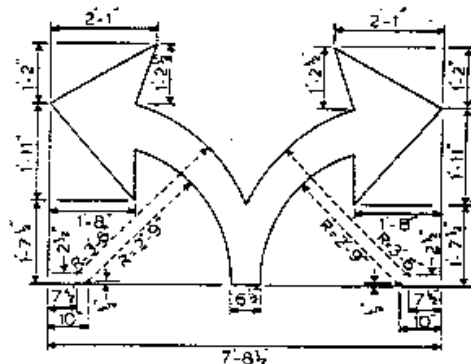
Right & Through Arrows  
L-24



Left & Through Arrows  
L-23



Through Arrow  
L-22



Left & Right Arrows  
L-17

Ref. Std. Spec. Sec. 8-22

APPROVED BY THE BOARD OF PUBLIC WORKS  
10/31/98  
ATTEST: *[Signature]* CHAIRMAN  
*[Signature]* SECRETARY

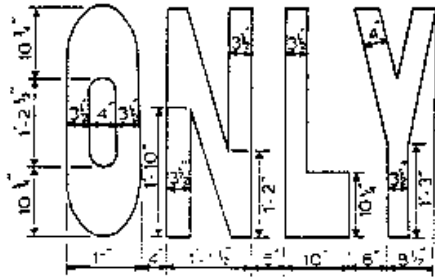
CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Pavement Markings  
Legends/Symbols

220

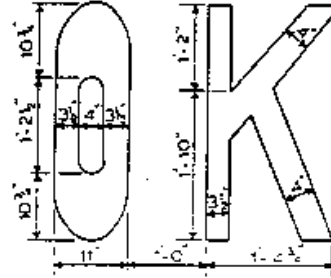
00850-14

Standard Plan No. 721



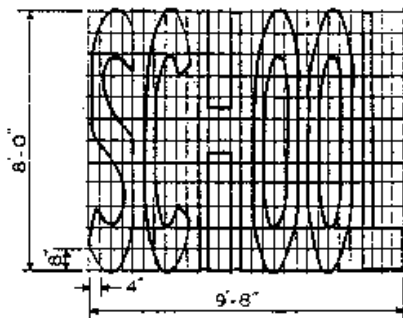
"ONLY" Legend

L-25



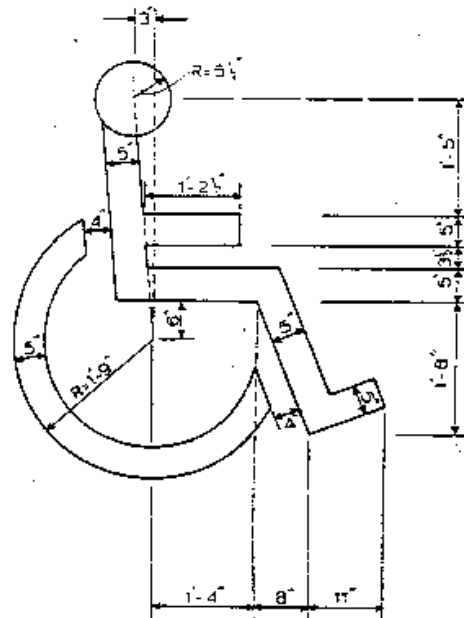
"OK" Legend

L-26



"SCHOOL" Legend

L-35



Disabled Person Symbol

L-29

Ref Std. Spec. Sec. 8-22

APPROVED BY THE BOARD OF PUBLIC WORKS  
10/31/14  
ATTEST: *[Signature]* CHAIRMAN  
*[Signature]* SECRETARY

CITY OF SEATTLE  
DEPARTMENT OF ENGINEERING

Pavement Markings  
Legends / Symbols

221

00850-15

**Abstracts of the 11th Annual Meeting of the American Society of Human Genetics, 1993, Denver, Colorado, September 13-17, 1993**



Approved May 7, 1993

5-26-95	Revised process base section and notes.	SP	11/10/95
5-1-93	Revised notes and assigned.	SPB	11/10/95
DATE	REVISION	BY	DATE

Frame and grate  
— see Standard Plan  
for details



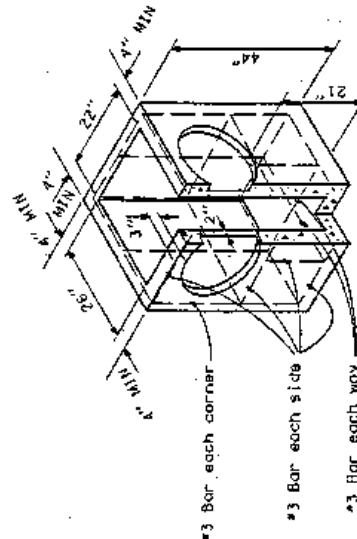
A diagram of a diamond-shaped lattice structure, likely a truss or a decorative element. The structure is composed of interconnected diamond shapes. Dimensions are given in inches: the overall width is 30", the height is 36", and the side lengths of the diamonds are 5". A label "hoop" points to one of the horizontal members.

1 - #3 Bar hoop-

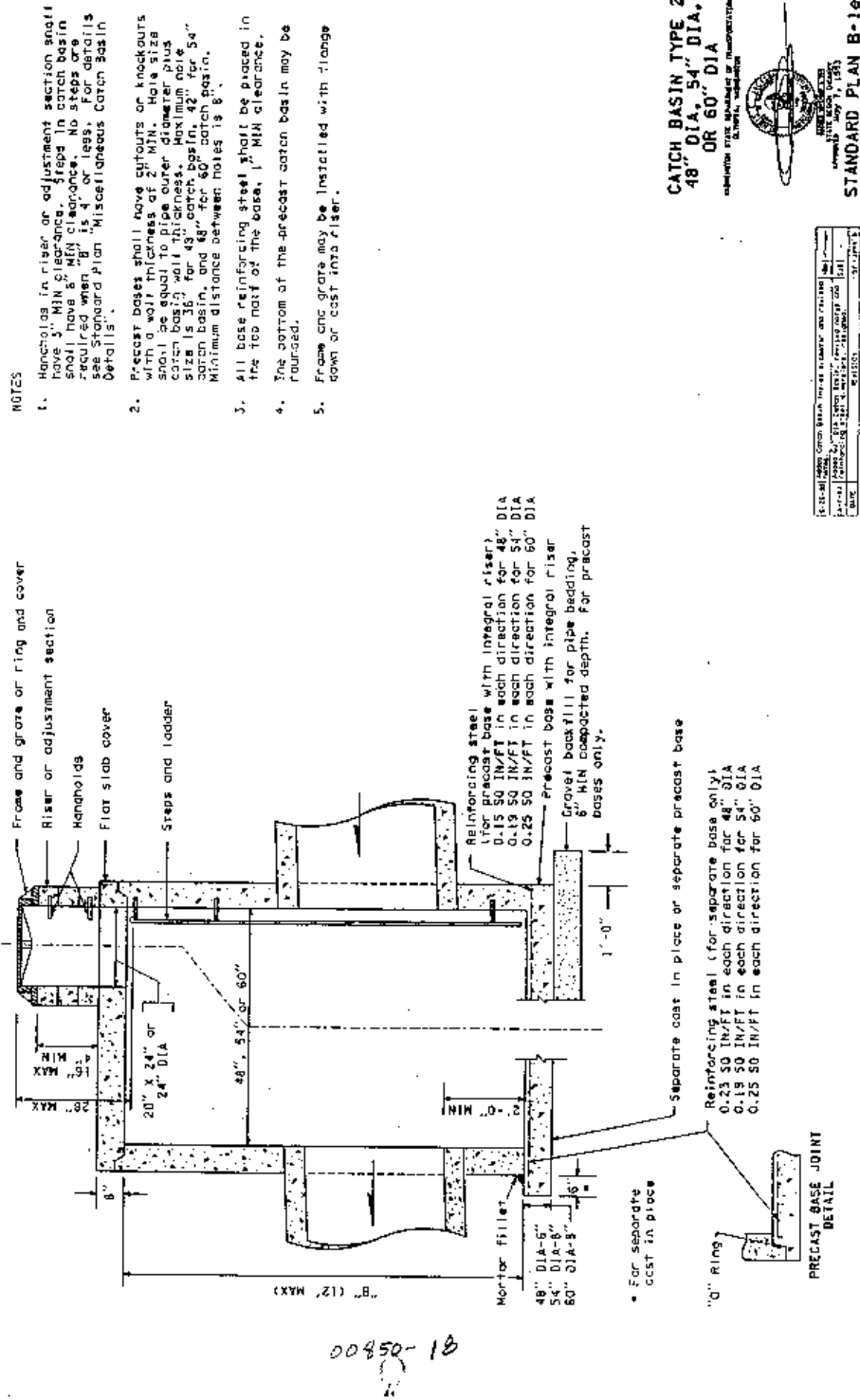
[illegible]

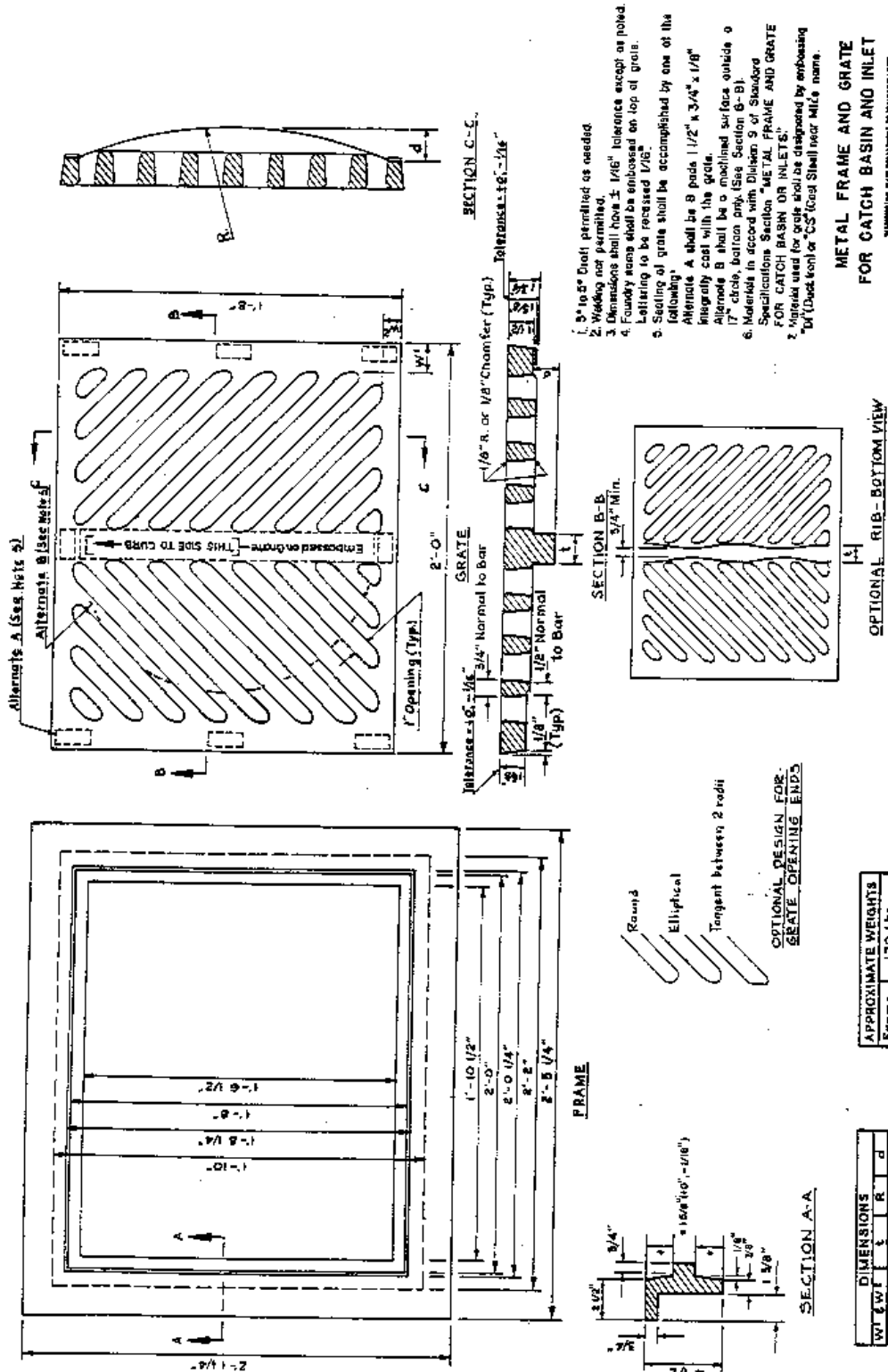
2 - #3 Bar Hoop

Precast Base Section  
(Measurement at the top  
of the base)



00850-17









Approximate weight = 101 lbs.

## SUBMETER INVENTORY FORM

Combined Utility Acct. Number: \_ \_ \_ \_ \_ - \_ \_ \_ \_

Service Address: \_ \_ \_ \_ \_

☐ Replacement of old meter: ☐no ☐yes - fill out below

Old Manufacturer name: \_ \_ \_ \_ \_

Old Manufacturer serial number: \_ \_ \_ \_ \_

Old read & Date: \_ \_ \_ \_ \_

☐ New Installation:

Manufacturer name: \_ \_ \_ \_ \_

Manufacturer serial number: \_ \_ \_ \_ \_

Number of digits on meter dial: ☐5 ☐6 ☐7 ☐8 ☐9  
(including fixed or painted 0's)

Number of fixed or painted 0's after rolling dials: ☐none ☐1 ☐2 ☐3

Verify meter reads in CUBIC FEET: ☐

Current read and date: \_ \_ \_ \_ \_ Installation date: \_ \_ \_ \_ \_

Meter Size: ☐3/4" or 5/8" ☐1" ☐1-1/2" ☐2"

Meter location: \_ \_ \_ \_ \_

Meter measures water used for: ☐irrigation ☐cooling ☐product ☐ships

Contacts: Reading access \_ \_ \_ \_ \_ Phone \_ \_ \_ \_ \_  
Maintenance \_ \_ \_ \_ \_ Phone \_ \_ \_ \_ \_

Please direct questions to KAREN MCGREW (206) 684-3818  
BE SURE TO NOTIFY SPU IF YOU EXCHANGE OR MOVE YOUR METER

**METERS APPROVED FOR INSTALLATION IN CONNECTION  
WITH WASTEWATER CHARGES UNDER ORDINANCE #84390**

**METERS MUST REGISTER IN CUBIC FEET  
AND BE ACCESSIBLE TO METER READER**

CARLON	Familian Northwest, Inc. 7115 W. Marginal Wy. S.W. Seattle WA 98106	767-7700
HAYS	Romac Industries, Inc. 1064 4TH AV. S. Seattle WA 98168	624-6491
HERSEY	Branom Instrument Co. 5500 4TH AV. S. Seattle WA 98108	762-6050
PRECISION NEPTUNE	Pacific Water Works 415 S. Holgate St. Seattle WA 98134	223-0400
ROCKWELL	Fog-Tite Meter Seal Co., Inc. 4819 W. Marginal Wy. S.W. Seattle WA 98106	935-8000
SIGNET	Branom Instrument Co. 5500 4TH AV. S. Seattle WA 98108	762-6050
TRIDENT- NEPTUNE	Nebor Supply Co., Inc. 430 Minor Av. N. Seattle WA 98109	622-6292

END OF SECTION

99020/AN  
FORT LAWTON PHASE TWO

083001

General Decision Number WA990002

General Decision Number WA990002

Superseded General Decision No. WA980002

State: Washington

Construction Type:  
BUILDING

County(ies):

CHELAN	KITSAP	PIERCE
CLALLAM	KITTITAS	SNOHOMISH
GRAYS HARBOR	LEWIS	THURSTON
JEFFERSON	MASON	
KING	PACIFIC	

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	03/12/1999

COUNTY(ies):

CHELAN	KITSAP	PIERCE
CLALLAM	KITTITAS	SNOHOMISH
GRAYS HARBOR	LEWIS	THURSTON
JEFFERSON	MASON	
KING	PACIFIC	

ASBE0007A 06/01/1998

	Rates	Fringes
ASBESTOS WORKERS/INSULATORS: (Includes application of all insulating materials, protective coverings, coating and finishes to all types of mechanical systems)	23.41	8.85

B0IL0242B 10/01/1998

CHELAN AND KITTITAS COUNTIES		
	Rates	Fringes
BOILERMAKERS	24. 07	9. 81
-----		
BOIL0502B 10/01/1996		
	Rates	Fringes
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES		
BOILERMAKERS	24. 32	9. 01
-----		
BRWA0001A 05/01/1998		
	Rates	Fringes
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTHERN HALF), PIERCE, SNOHOMISH AND THURSTON COUNTIES		
BRICKLAYERS	25. 50	6. 17
-----		
BRWA0001F 06/01/1997		
	Rates	Fringes
PACIFIC COUNTY (SOUTHERN PART)		
BRICKLAYERS	23. 86	6. 21
MARBLE MASONS	24. 86	6. 21
-----		
BRWA0001G 05/01/1997		
	Rates	Fringes
PACIFIC (SOUTHERN PORTION) COUNTY		
TILE SETTER AND TERRAZZO WORKERS	22. 18	5. 82
TILE AND TERRAZZO FINISHERS	16. 77	4. 27
-----		
BRWA0001H 06/01/1998		
	Rates	Fringes
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTHERN HALF), PIERCE, THURSTON AND SNOHOMISH COUNTIES		
TILE AND TERRAZZO WORKERS	23. 42	5. 61
TILE AND TERRAZZO FINISHERS	18. 91	5. 46
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BRWA0003A 06/01/1998

	Rates	Fringes
CHELAN AND KITTITAS COUNTIES		

BRICKLAYERS	21. 79	6. 83
-------------	--------	-------

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BRWA0003E 04/01/1995

	Rates	Fringes
CHELAN AND KITTITAS		

TERRAZZO WORKERS	17. 50	5. 38
TILE LAYER	17. 00	5. 38
TILE AND TERRAZZO FINISHERS	13. 70	5. 38

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CARP0770E 06/01/1998

	Rates	Fringes
WESTERN WASHINGTON: CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTH), PIERCE, SNOHOMISH AND THURSTON COUNTIES		

CARPENTERS AND DRYWALL APPLICATORS	24. 50	6. 27
CARPENTERS ON CREOSOTE MATERIAL	23. 60	6. 27
INSULATION APPLICATORS	21. 40	6. 27
SAWFILERS, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLER, FLOOR SANDER OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS	24. 63	6. 27
MILLWRIGHT AND MACHINE ERECTORS	25. 50	6. 27
ACOUSTICAL WORKERS	24. 66	6. 27
PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CREOSOTE TREATED MATERIAL, ALL PILING	24. 70	6. 27
PILEDRIVER, BRIDGE DOCK & WHARF CARPENTERS	24. 50	6. 27
DIVERS	60. 52	6. 27
DIVERS TENDER	26. 92	6. 27

(HOURLY ZONE PAY APPLICABLE TO ALL CLASSIFICATIONS EXCEPT  
MILLWRIGHT AND PILEDRIVER)

Hourly Zone Pay shall be paid on jobs located outside  
of the free zone computed from the city center of the  
following listed cities:

Seattle

Olympia

Bellingham

Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay		
0 - 25	radius miles	Free
25- 35	radius miles	\$1. 00/hour
35- 45	radius miles	\$1. 15/hour
45- 55	radius miles	\$1. 35/hour
Over 55	radius miles	\$1. 55/hour

(HOURLY ZONE PAY - MILLWRIGHTS AND PILEDRIVERS ONLY)

Hour Zone Pay shall be computed from Seattle Union Hall, Tacoma City center, and Everett City center

Zone Pay		
0 - 25	radius miles	Free
25- 45	radius miles	\$ . 70/hour
Over 45	radius miles	\$1. 50/hour

Millwrights and Piledrivers who reside in Aberdeen, Bellingham, Port Angeles, Mount Vernon, Olympia, Wenatchee, or Yakima Local Union jurisdiction areas, working on jobs in their respective area, shall have their Zone Pay measured from their respective city center

CENTRAL WASHINGTON: CHELAN AND KITTITAS COUNTIES

CARPENTERS AND DRYWALL APPLICATORS	19. 77	6. 27
CARPENTERS ON CREOSOTED MATERIALS	19. 87	6. 27
INSULATION APPLICATORS	19. 77	6. 27
SAWFILER, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLERS, FLOOR SANDER OPERATOR AND OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS	19. 90	6. 27
MILLWRIGHTS AND MACHINE ERECTORS	25. 50	6. 27
ACCOUSTICAL WORKERS	20. 03	6. 27
PILDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING, OR CREOSOTE TREATED MATERIAL, ALL PILING	24. 70	6. 27
PILEDRIIVER, BRIDGE DOCK & WHARF CARPENTERS	24. 50	6. 27



DIVERS	58.07	6.27
DIVERS TENDER	25.83	6.27

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CARP9003A 06/01/1998

	Rates	Fringes
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PACIFIC COUNTY (South of a straight line made by extending the north boundary line of Wahkiakum County west to Willapa Bay to the Pacific Ocean, and thence north through the natural waterway to the Pacific Ocean (this will include the entire peninsula west of Willapa Bay)

SEE ZONE DESCRIPTION FOR CITIES BASE POINTS

## ZONE 1:

CARPENTERS	24.27	6.42
DRYWALL, ACOUSTICAL & LATHERS	20.48	6.27
FLOOR LAYERS & FLOOR FINISHERS (the laying of all hardwood floors nailed and mastic set, parquet and wood-type tiles, and block floors, the sanding and finishing of floors, the prepara- tion of old and new floors when the materials mentioned above are to be installed; INSULATORS (fiberglass and similar irritating material)	24.42	6.42
MILLWRIGHTS	24.77	6.42
PILEDIVERS	24.77	6.42
DIVERS	55.03	6.42
DIVERS TENDERS	25.59	6.42

Zone Differential (Add to Zone 1 rates):

Zone 2 - \$0.85  
 Zone 3 - 1.25  
 Zone 4 - 1.70  
 Zone 5 - 2.00  
 Zone 6 - 3.00

BASEPOINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects located within 30 miles of the respective city hall of the above mentioned cities  
 ZONE 2: Projects located more than 30 miles and less than 40 miles of the respective city of the above mentioned cities  
 ZONE 3: Projects located more than 40 miles and less than 50 miles of the respective city of the above mentioned cities  
 ZONE 4: Projects located more than 50 miles and less than 60 miles of the respective city of the above mentioned cities

miles of the respective city of the above mentioned cities.

ZONE 5: Projects located more than 60 miles and less than 70 miles of the respective city of the above mentioned cities

ZONE 6: Projects located more than 70 miles of the respected city of the above mentioned cities

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ELEC0046B 06/01/1998		
	Rates	Fringes
CALLAM, JEFFERSON, KING AND KITSAP COUNTIES		
ELECTRICIANS	27. 50	7. 50+3%
CABLE SPLICERS	30. 25	7. 50+3%

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ELEC0046C 06/03/1996		
	Rates	Fringes
CALLAM, JEFFERSON, KING, KITSAP COUNTIES		
SOUND AND COMMUNICATION TECHNICIAN	17. 38	2. 75+3%

#### SCOPE OF WORK

Includes the installation, testing, service and maintenance, of the following systems which utilize the trabsmission and/or transference of voice, sound vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, fire alarms and life safety systems (hang, terminate devices and panels and to conduct functional and systems tests), and low voltage master clock systems.

#### WORK EXCLUDED

Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems.

Energy management systems.

SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope).

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ELEC0076A 07/01/1998

	Rates	Fringes
GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE, THURSTON COUNTIES		

ELECTRICIANS	24.37	9.04+3%
CABLE SPLICERS	26.81	9.04+3%

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ELEC0076D 06/01/1997

	Rates	Fringes
GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE AND THURSTON COUNTIES		

SOUND AND COMMUNICATIONS TECHNICIAN	16.88	3.79
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#### SCOPE OF WORK

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

#### WORK EXCLUDED

Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems.

Energy management systems.

SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope).

Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:

1. The project involves new or major remodel building trades construction.

2. The conductors for the fire alarm system are installed in conduit.

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ELEC0112B 06/01/1998		
	Rates	Fringes
KITTITAS COUNTY		
ELECTRICIANS	26.20	6.83+3%
CABLE SPLICERS	27.51	6.83+3%

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ELEC0112G 03/16/1996		
	Rates	Fringes
KITTITAS COUNTY		
COMMUNICATION & SOUND TECHNICIANS	15.97	3.61

#### SCOPE OF WORK

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound vision and digital for commercial,

education, security and entertainment purposes for the following TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, and low voltage master clock systems.

#### WORK EXCLUDED

Raceways systems are not covered (excluding Ladder-Rack for the purpose for the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems.

Energy management systems.

SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope).

Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:

1. The project involves new or major remodel building trades construction.

2. The conductors for the fire alarm system are installed in conduit.

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ELEC0191A 06/01/1998		
	Rates	Fringes
SNOHOMISH COUNTY		
ELECTRICIANS	25.34	6.63+3%
CABLE SPLICERS	27.87	6.63+3%
CHELAN COUNTY		
ELECTRICIANS	23.19	6.63+3%
CABLE SPLICERS	25.51	6.63+3%

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ELEC0191E 05/31/1997		
	Rates	Fringes
CHELAN AND SNOHOMISH COUNTIES		
SOUND AND COMMUNICATIONS		
TECHNICIANS	17.69	2.30+3%

#### SCOPE OF WORK

Includes the installation testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventor control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms,

and low voltage master clock systems.

#### WORK EXCLUDED

Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems.

Energy management systems.

SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope).

Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:

1. The project involves new or major remodel building trades construction.

2. The conductors for the fire alarm system are installed in conduit.

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ELEV0019B 07/01/1998

	Rates	Fringes
CHELAN, CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, KITTITAS, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES		

ELEVATOR MECHANICS	29.105	6.405+a
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FOOTNOTE a: Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day.

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ELEV0023B 04/01/1998

	Rates	Fringes
PACIFIC COUNTY		

ELEVATOR MECHANIC	29.185	6.405+a
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FOOTNOTE a: Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day, and New Years Day.

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ENGI0302B 06/01/1998

	Rates	Fringes
CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, KITTITAS, MASON AND SNOHOMISH COUNTIES		

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS.

ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

**POWER EQUIPMENT OPERATORS:**

**Zone 1 (0-25 radius miles):**

GROUP 1 AAA	26.66	7.13
GROUP 1AA	26.16	7.13
GROUP 1A	25.66	7.13
GROUP 1	25.16	7.13
GROUP 2	24.72	7.13
GROUP 3	24.36	7.13
GROUP 4	22.26	7.13

**Zone Differential (Add to Zone 1 rates):**

Zone 2 (26-45 radius miles) - \$ .70

Zone 3 (Over 45 radius miles) - \$1.00

**BASEPOINTS:** Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

**POWER EQUIPMENT OPERATORS CLASSIFICATIONS**

**GROUP 1AAA -** Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

**GROUP 1AA -** Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom

**GROUP 1A -** Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

**GROUP 1 -** Cableway; Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader-overhead 6 yards to, but not including 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9, HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self propelled 45 yards and over; Slipform pavers; Transporters, all truck or track type

**GROUP 2 -** Barrier machine (zipper); Batch Plant Operator-Concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons;

Chipper; Concrete Pump-truck mount with boom attachment; Crusher; Deck Engineer/Deck Winches (power); Drilling machine; Excavator, shovel, backhoe-3yards and under; Finishing Machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Horizontal/directional drill operator; Loaders-overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics-all;

Mixers-asphalt plant; Motor patrol graders-finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrade trimmer; Tractors, backhoes-over 75 hp; Transfer material service machine-shuttle buggy, blaw knox-roadtec; Truck crane oiler/driver-100 tons and over; Truck Mount portable conveyor; Yo Yo Pay dozer

GROUP 3 - Conveyors; Cranes-thru 19 tons with attachments; A-frame crane over 10 tons; Drill oilers-auger type, truck or crane mount; Dozers-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loader-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler-asphalt, crusher; Pumps-concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrpers-concrete and carry-all; Service engineer-equipment; Trenching machines; Truck Crane Oiler/Driver under 100 tons; Tractors, backhoe 75 hp and under

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete finish mahine-laser screed; Cranes-A frame-10 tons and under; Elevator and Manlift-permanent or shaft type; Gradechecker, Stakehop; Forklifts under 3000 lbs. with attachments; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger, mechanical; Power plant; Pumps, water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than \$1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than \$1 million where no building is involved. Surfacing and paving included, but utilities excluded.
3. Marine projects (docks, wharfs, etc.) less than \$150,000.



**HANDLING OF HAZARDOUS WASTE MATERIALS:** Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing

H-2 Class "C" Suit - Base wage rate plus \$ .25 per hour.

H-3 Class "B" Suit - Base wage rate plus \$ .50 per hour.

H-4 Class "A" Suit - Base wage rate plus \$ .75 per hour.

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ENGI0370I 06/01/1998

	Rates	Fringes
CHELAN (EAST OF THE 120TH MERIDIAN) COUNTY		

ZONE 1:

**POWER EQUIPMENT OPERATORS:**

GROUP 1A	19.41	5.40
GROUP 1	19.95	5.40
GROUP 2	20.26	5.40
GROUP 3	20.85	5.40
GROUP 4	21.01	5.40
GROUP 5	21.16	5.40
GROUP 6	21.43	5.40
GROUP 7	21.70	5.40
GROUP 8	22.76	5.40

ZONE DIFFERENTIAL (Add to Zone 1 rate): Zone 2 - \$2.00

Zone 1: Within 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Moses Lake, Pasco, Washington; Lewiston, Idaho

**POWER EQUIPMENT OPERATORS CLASSIFICATIONS**

GROUP 1A: Boat Operator; Crush Feeder; Oiler; Steam Cleaner

GROUP 1: Bit Grinders; Bolt Threading Machine; Compressors (under 2000 CFM, gas, diesel, or electric power); Deck Hand; Drillers Helper (assist driller in making drill rod connections, service drill engine and air compressor, repair drill rig and drill tools; drive drill support truck to and on the job site, remove drill cuttings from around bore hole and inspect drill rig

while in operation); Fireman & Heat Tender; Grade Checker; Hydro-seeder, Mulcher, Nozzlemán; Oiler Driver, & Cable Tender, Mucking Machine; Pumpman; Rollers, all types on subgrade, including seal and chip coatings (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by Dozer with operable blade; Welding Machine

GROUP 2: A-frame Truck (single drum); Assistant Refrigeration Plant (under 1000 ton); Assistant Plant Operator, Fireman or Pugmíxer (asphalt); Bagley or Stationary Scraper; Belt Finishing Machine; Blower Operator (cement); Cement Hog; Compressor (2000 CFM or over, 2 or more, gas diesel or electric power); Concrete Saw (multiple cut); Distributor Leverman; Ditch Witch or similar; Elevator Hoisting Materials; Dope Pots (power agitated); Fork Lift or Lumber Stacker, hydra-lift & similar; Gin Trucks (pipeline); Hoist, single drum; Loaders (bucket elevators and conveyors); Longitudinal Float; Mixer (portable-concrete); Pavement Breaker, Hydra-Hammer & similar; Power Broom; Railroad Ballast Regulation Operator (self-propelled); Railroad Power

Tamper Operator (self-propelled); Railroad Tamper Jack Operator (self-propelled); Spray Curing Machine (concrete); Spreader Box (self-propelled); Straddle Buggy (Ross & similar on construction job only); Tractor (Farm type R/T with attachment, except Backhoe); Tugger Operator

GROUP 3: A-frame Truck (2 or more drums); Assistant Refrigeration Plant & Chiller Operator (over 1000 ton); Backfillers (Cleveland & similar); Batch Plant & Wet Mix Operator, single unit (concrete); Belt-Crete Conveyors with power pack or similar; Belt Loader (Kocal or similar); Bending Machine; Bob Cat; Boring Machine (earth); Boring Machine (rock under 8" bit) (Quarry Master, Joy or similar); Bump Cutter (Wayne, Saginaw or similar); Canal Lining Machine (concrete); Chipper (without crane); Cleaning & Doping Machine (pipeline); Deck Engineer; Elevating Belt-type Loader (Euclid, Barber Green & similar); Elevating Grader-type Loader (Dumor, Adams or similar); Generator Plant Engineers (diesel or electric); Gunnite Combination Mixer & Compressor; Locomotive Engineer; Mixermobile; Mucking Machine; Posthole Auger or Punch; Pump (grout or jet); Soil Stabilizer (P & H or similar); Spreader Machine; Tractor (to D-6 or equivalent) and Traxcavator; Traverse Finish Machine; Turnhead Operator

GROUP 4: Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman & similar); Curb Extruder (asphalt or concrete); Drills (churn, core, calyx or diamond) (Operate drilling machine, drive or transport drill rig to and on job site and weld well casing); Equipment Serviceman, Greaser & Oiler; Hoist (2 or more drums or Tower Hoist); Loaders (overhead & front-end, under 4 yds. R/T); Refrigeration Plant Engineer (under 1000 ton); Rubber-tired Skidders (R/T with or without attachments); Surface Heater & Planer Machine; Trenching Machines (under 7 ft. depth capacity); Turnhead (with re-screening); Vacuum Drill (reverse circulation drill under 8" bit)

GROUP 5: Backhoe (under 45,000 gw); Backhoe and Hoe Ram (under 3/4 yd.); Carrydeck & boom truck (under 25 tons); Cranes (25 tons & under), all attachments including clamshell, dragline); Derricks & Stifflegs (under 65 tons); Drilling Equipment (8" bit & over) (Robbins, reverse circulation & similar) (operates drill machine, drive or transport drill rig to and on job site and weld well casing); Hoe Ram; Piledriving Engineers; Paving (dual drum); Railroad Track Liner Operator (self-propelled); Refrigeration Plant Engineer (1000 tons & over); Signalman (Whirleys, Highline Hammerheads or similar)

GROUP 6: Asphalt Plant Operator; Automatic Subgrader (Ditches & Trimmers) (Autograde, ABC, R. A. Hansen & similar on grade wire); Backhoe (45,000 gw and over to 110,000 gw); Backhoes & Hoe Ram (3/4 yd. to 3 yd.); Batch Plant (over 4 units); Batch & Wet Mix Operator (multiple units, 2 & incl. 4); Blade Operator (Motor Patrol & Attachments, Athey & Huber); Boom Cats (side); Cableway Controller (dispatcher); Clamshell Operator (under 3 yds.); Compactor (self-propelled with blade); Concrete Pump Boom Truck; Concrete Slip Form Paver; Cranes (over 25 tons including 45 tons), all attachments including clamshell, dragline; Crusher,

Grizzle & Screening Plant Operator; Dozer, 834 R/T & similar; Draglines (under 3 yds.); Drill Doctor; H. D. Mechanic; H. D. Welder; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.); Multiple Dozer Units with single blade; Paving Machine (asphalt and concrete); Quad-Track or similar equipment; Roller (finishing asphalt pavement); Roto Mill (pavement grinder); Scrapers, all rubber-tired; Screed Operator; Shovel (under 3 yds.); Tractors (D-6 & equivalent & over); Trenching Machines (7 ft. depth & over); Tug Boat Operator; Vactor Guzzler, super sucker

GROUP 7: Backhoe (over 110,000 gw); Backhoes & Hoe Ram (3 yds. & over); Blade (finish & bluetop), Automatic, CMI, ABC, Finish Athey & Huber & similar when used as automatic; Cableway Operators; Clamshell Operator (3 yds. & over); Cranes (over 45 tons to but not including 85 tons), all attachments including clamshell and dragline; Derricks & Stifflegs (65 tons & over); Draglines (3 yds. & over); Elevating Belt (Holland type); Heavy Equipment Robotics Operator; Loader (360 degrees revolving Koehring Scooper or similar); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Shovels (3 yds. & over); Ultra High Pressure Waterjet Cutting Tool System Operator (30,000 psi); Vacuum Blasting Machine Operator; Whirleys & Hammerheads, ALL

GROUP 8: Cranes (85 tons and over, and all climbing, overhead, rail and tower); Loaders (overhead and front-end, 10 yards and over); Helicopter Pilot

**BOOM PAY:** (All Cranes, Including Tower)  
 180' to 250' \$. 30 over scale  
 Over 250' \$. 60 over scale

**NOTE:** In computing the length of the boom on Tower Cranes, they shall be measured from the base of the tower to the point of the boom

**HAZMAT:** Anyone working on HAZMAT jobs, working with supplied air shall receive \$1.00 an hour above classification.

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ENGI0612B 06/01/1998

Rates                      Fringes

**LEWIS, PIERCE, PACIFIC** (portion lying north of a parallel line extending west from the northern boundary of Wahkaikum County to the sea) **AND THURSTON COUNTIES**

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

**POWER EQUIPMENT OPERATORS:**  
**Zone 1 (0-25 radius miles):**

GROUP 1AAA	26. 66	7. 13
GROUP 1AA	26. 16	7. 13
GROUP 1A	25. 66	7. 13
GROUP 1	25. 16	7. 13
GROUP 2	24. 72	7. 13
GROUP 3	24. 36	7. 13
GROUP 4	22. 26	7. 13

**Zone Differential (Add to Zone 1 rates):**  
 Zone 2 (26-45 radius miles) = \$ . 70  
 Zone 3 (Over 45 radius miles) - \$1.00

**BASEPOINTS:** CENTRALIA, OLYMPIA, TACOMA

#### POWER EQUIPMENT OPERATORS CLASSIFICATIONS

**GROUP 1 AAA - Cranes-over 300 tons or 300 ft of boom (including jib with attachments)**

**GROUP 1AA - Cranes- 200 tonsto 300 tons, or 250 ft of boom (including jib with attachments; Tower crane over 175 ft in**

height, base to boom

**GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments**

**GROUP 1 - Cableway; Cranes 45 tons thru 99 tons under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader-overhead, 6 yards to, but not including, 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9 HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self-propelled 45 yards and over; Slipform pavers; Transporters, all track or truck type**

**GROUP 2 - Barrier machine (zipper); Batch Plant Operator-concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-Overhead, bridge type, 20 tons through 44 tons; Chipper; Concrete pump-truck mount with boom attachment; Crusher; Deck engineer/deck winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Loaders, overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics- all; Mixers, asphalt plant; Motor patrol graders, finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self-propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrader trimmer; Tractors, backhoe over 75 hp; Transfer material service machine-shuttle buggy, Blaw Knox-Roadtec; Truck Crane oiler/driver-100 tons and over; Truck Mount Portable Conveyor; Yo Yo pay**

**GROUP 3 - Conveyors; Cranes through 19 tons with attachments; Crane-A-frame over 10 tons; Drill oilers-auger type, truck or crane mount; Dozer-D-9 and under; Forklift-3000 lbs. and over with attachments; Horizontal/directional drill locator; Outside Hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loaders-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler-asphalt, crusher; Pump-Concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrapers, concrete and carry all; Service engineers-equipment; Trenching machines; Truck crane oiler/driver under 100 tons; Tractors, backhoe under 75 hp**

**GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete Finish Machine-laser screed; Cranes A-frame 10 tons and under; Elevator and manlift (permanent and shaft type); Forklifts-under 3000 lbs. with attachments; Gradechecker,**

stakehop; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger-mechanical; Power plant; Pumps-water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than \$1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than \$1 million where no building is involved. Surfacing and paving included, but utilities excluded.
3. Marine projects (docks, wharfs, etc.) less than \$150,000.

**HANDLING OF HAZARDOUS WASTE MATERIALS:** Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

- H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing
  - H-2 Class "C" Suit - Base wage rate plus \$ .25 per hour.
  - H-3 Class "B" Suit - Base wage rate plus \$ .50 per hour.
  - H-4 Class "A" Suit - Base wage rate plus \$ .75 per hour.
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ENGI0701H 01/01/1999

CLARK, COWLITZ, KICKITAT, PACIFIC (SOUTH), SKAMANIA, AND WAHIAKUM COUNTIES

POWER EQUIPMENT OPERATORS (See Footnote A)

ZONE 1:

	Rates	Fringes
GROUP 1	25.91	8.20
GROUP 2	25.00	8.20
GROUP 3	24.30	8.20
GROUP 4	23.83	8.20
GROUP 5	23.27	8.20
GROUP 6	21.10	8.20

Zone Differential (add to Zone 1 rates):

Zone 2 - \$1.50

Zone 3 - 3.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 ON Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs located in Yamhill County, Washington County and Columbia County and all jobs or projects located in Clark and Cowlitz Counties, Washington except that portion of Cowlitz County in the Mt. St. Helens "Blast Zone" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; COOS, BAY; EUGENE; GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs of projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs of projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

#### POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: CONCRETE: Batch Plant and/or Wet Mix Operator, three units or more; CRANE: Crane Operator, over 200 tons; Whirley Operator 90 tons and over; Helicopter Operators, when used in erecting work; Floating Crane, 150 tons but less than 250 tons; Lattice Boom Crane - 200 tons and over, Boom 201' through 280'; FLOATING EQUIPMENT: Floating Crane, 250 tons and over

GROUP 2: ASPHALT: Asphalt Plant Operator (any type); Roto-

mill, pavement profiler, operator, six foot lateral cut and over; BLADE: Auto Grader or "Trimmer" Operator (Grade Checker required); BULLDOZERS: Tandem bulldozer operator, quad-nine and similar type; D-11; Tandem Bulldozer Operator, Quad-nine and similar type; CONCRETE: Batch Plant and/or Wet Mix Operator, one and two drum; Automatic Concrete Slip Form Paver Operator; Concrete Canal Line Operator; Concrete Profiler, Diamond Head; CRANE: Cableway Operator, 25 tons and over; Crane Operator, over 40 tons and including 100 tons; Crane Operator, over 100 tons and including 200; Tower Crane Operator, over 80 tons and including 150 tons; Whirley Operator - under 90 tons; Lattice Boom Crane - 90 through 199 tons, Boom = 150' through 200'; CRUSHER: Crusher Plant Operator; FLOATING EQUIPMENT: Floating Clamshell, etc. Operator, 3cu. yds. and over; Floating Crane (derrick barge) Operator, 30 tons but less than 80 tons; Floating Crane (derrick barge) Operator, 80 ton but less than 150 ton; LOADERS: Loader Operator, 6 cu. yds. but less than 12 cu. yds.; Loader Operator, 12 cu. yds. and over; REMOTE CONTROL: Remote controlled earth-moving equipment (no one operator shall operate more than two pieces of earth-moving equipment at one time); RUBBER-TIRED SCRAPERS: Rubber-tired Scraper Operator, with tandem scrapers, multi-engine; SHOVEL, DRAGLINE, CLAMSHELL, BACKHOE, SKOOPER, OPERATOR: Shovel, etc., 3 cu. yds., but less than 5 cu. yds.; Shovel, etc., 5 cu. yds. and over; TRENCH MACHINE: Wheel Excavator, under 750 cu. yds. per hour (Grade Oiler required); Canal Trimmer (Grade Oiler required); Wheel Excavator, over 750 cu. yds. per hour (two Operators and at least one Grade Oiler required); Band Wagon (in conjunction with wheel excavator); UNDERWATER EQUIPMENT: Underwater Equipment Operator, remote or otherwise, when used in construction work.

GROUP 3: CRANES: Lattice Boom Crane - 50 through 89 tons; FORKLIFT: Rock Hound Operator; LOADERS: Loader Operator, 4 cu. yds. but less than 6 cu. yds.; Rubber-tired RUBBER-TIRED SCRAPERS: Scraper Operator, with tandem scrapers; Self-loading, paddle wheel, auger type, finish and/or 2 or more units

GROUP 4: ASPHALT: Screed Operator; Asphalt Paver Operator (Screed man required); Diesel-Electric engineer, Plant; Roto-Mill, pavement profiler, operator, under six foot lateral cut; BLADE: Blade Operator, externally controlled by electronic, mechanical hydraulic means; Blade operator, multi-engine; BULLDOZERS: Bulldozer Operator; Drill Cat Operator; Side-boom Operator; Bulldozer Operator, twin engine (TC 12 and similar type, D-10); Cable-Plow Operator (any type); CLEARING: Log Skidders; Chippers; Incinerator; Stump Splitter (loader mounted or similar type); Compactor Operator, with blade; Compactor Operator, multi-engine; CONCRETE: Mixer Mobile Operator; Screed Operator; Concrete Cooling Machine Operator; Concrete Paving Road Mixer; Concrete Breaker; Reinforced Tank Banding Machine (K-17 or similar types); CRANE: Chicago boom and similar types; Lift Slab Machine Operator; Boom type lifting device, 5 ton capacity or less; Cherry Picker or similar type crane-hoist, 5 ton capacity or less; Crane Operator, under 25 ton (except for rough terrain),



Hoist Operator, two drum; Hoist Operator, three or more drums; Derrick Operator, under 100 ton; Hoist Operator, stiff leg, guy derrick or similar type, 50 ton and over; Cableway Operator, up to twenty-five ton; Crane Operator, over twenty-five ton and including forty ton; Bridge Crane Operator; Locomotive, Gantry, Overhead; Lattice Boom Crane - 25 through 49 tons; CRUSHER: Generator Operator; Diesel-Electric Engineer; Grizzley Operator; DRILLING: Drill Doctor; Boring Machine Operator; Driller-Percussion, Diamond, Core, Cable, Rotary and similar type; Cat Drill (John Henry); FLOATING EQUIPMENT: Diesel-electric Engineer; Jack Operator, elevating barges, Barge Operator, self-unloading; Piledriver Operator (not crane type) (Deckhand required); Floating Clamshell, etc. Operator, under 3 cu. yds. (Fireman or Diesel-Electric Engineer required); Floating Crane (derrick barge) Operator, less than 30 tons; GENERATORS: Generator Operator; Diesel-electric Engineer required); GUARDRAIL EQUIPMENT: Guardrail Punch Operator (all types); Guardrail auger Operator (all types); Combination Guardrail machines, i.e. punch, auger, etc.; HEATING PLANT: Surface Heater and Planer Operator; HYDRAULIC HOES: Hydraulic Backhoe Operator, Track Type 3/8 cu. yd. takes shovel Classif. rate); LOADERS: Belt Loaders, Kolman and Ko Cal types; Loaders Operator, front end and overhead, 2-1/2 cu. yds. and under 4 cu. yds.; Elevating Loader Operator, Athey and asimilar types; Elevating Grader Operator, operated by Tractor Operator, sierra, Euclid or similar types; PILEDRIVERS: Hammer Operator; Piledriver Operator (not crane type); Pipe Cleaning Machine Operator; Pipe Doping Machine Operator; PIPELINE, SEWER WATER: Pipe Bending Machine Operator; Pipe Wrapping Machine Operator; Boring Machine Operator; Back Filling Machine Operator; REPAIRMEN, HEAVY DUTY: Diesel-Electric Engineer (Plant or Floating); Bolt Treading Machine Operator; Drill Doctor (bit grinder); H. D. Mechanic; H. D. Welder; Machine Tool Operator; Combination H. D. Mechanic-Welder, when dispatched and/or when required to do both; Welder-Certified, when dispatched and/or required; RUBBER-TIRED SCRAPERS: Rubber-tired Scraper Operator, single engine, single scraper; Self-loading, paddle wheel, auger type under 15 cu. yds.; rubber-tired Scraper Operator, twin engine; Rubber-tired Scraper Operator, with push-pull attachments; Self-loading, paddle wheel, auger type 15 cu. yds. and over, single engine; SHOVEL, DRAGLINE, CLAMSHELL, BACKHOE, SKOOPER OPERATOR: Diesel-Electric Engineer; Stationary Drag Scraper Operator; Shovel, Dragline, Clamshell, Hoe, etc., Operator, under 1 cu. yd.; Shovel, etc., 1 cu. yd. and less than 3 cu. yds.; Grade-all Operator, under 1 cu. yd.; Grade-all 1 cu. yd. and over; SURFACING (BASE) MATERIALS: Blade Mounted Spreaders, Ulrich and similar types; TRACTOR-RUBBER TIRED: Tractor Operator, rubber-tired, over 50 H.P. Flywheel; Tractor Operator, with boom attachment; Rubber-tired Dozers and Pushers (Michigan, Cat, Hough type); TRENCHING MACHINE: Trenching Machine Operator, maximum digging capacity over 3 ft. depth (Grade Oiler required); Back Filling Machine Operator; TUNNEL: Mucking Machine Operator; Shield Operator; Boring Machine Operator

GROUP 5: ASPHALT: Extrusion Machine Operator; Roller Operator (any asphalt mix); Asphalt Burner and reconditioner Operator (any

type), 84; roto-mill, Pavement Profiler, ground man.; COMPRESSORS: Compressor Operator any power), over 1,250 cu. ft. total capacity; COMPACTORS: Compactor Operator, including vibratory; Wagner Pactor Operator or similar type (without blade); CONCRETE: Combination mixer and Compressor Operator, guniting work; Concrete Batch Plant Quality Control Operator; Beltcrete Operator; Pumpcrete Operator (any type) Pavement Grinder and/or Grooving Machine Operator (riding type); Cement Pump Operator, Fuller-Kenyon and similar; Concrete Pump Operator; Grouting Machine Operator; Concrete Mixer Operator, single drum, under five bag capacity and over; Cast place pipe laying machine; Maginnis Internal Full Slab Vibrator Operator; Concrete Finishing machine Operator, Clary, Johnson, Bidwell, Burgess bridge deck or similar type; Curb Machine Operator, mechanical Berm, Curb and/or Curb and Gutter; Concrete Joint Machine Operator; Concrete Planer Operator; Tower Mobile Operator; Power Jumbo Operator setting slip forms; Concrete Paving Machine Operator; Concrete Finishing Machine Operator; Concrete Spreader Operator; CRANE: Helicopter Hoist Operator; Hoist Operator, single drum; Elevator Operator; A-frame Truck Operator, Double drum; Boom Truck Operator Hydraulic Boom Truck, Pittman; DRILLING: Churn Drill and earth Boring Machine Operator; FLOATING EQUIPMENT: Fireman; FORKLIFT: Lull Hi-Lift Operator or similar type; Fork Lift, over 5 ton; HYDRAULIC HOES: Hydraulic Backhoe Operator, wheel type 3/8 cu. yd and under with or without front end attachment 2-1/2 cu. yds. and under (Ford, John Deere, Case, Type); LOADERS: Loaders, rubber-tired type, 2-1/2 cu. yds. and under; Elevating Grader Operator, Tractor Towed requiring Operator or Grader; OILERS: Service Oiler (Greaser); PIPELINE, SEWER WATER: Hydra Hammer or similar types; Pavement Breaker Operator; RAILROAD EQUIPMENT: Locomotive Operator, under 40 tons; Ballast Regulator Operator; Ballast Tamper Multi-Purpose Operator; Track Liner Operator; Tie Spacer Operator; Shuttle Car Operator; Locomotive Operator, 40 tons and over; SURFACING (BASE) MATERIAL: Roller Operator, Oiling, C.T.B.; Rock Spreaders self-propelled; Pulva-mixer or similar types; Chip Spreading Machine Operator Lime Spreading Operator, construction job site; SWEEPERS: Sweeper Operator (Wayne Tractor Operator, rubber-tired, 50 H.P. Flywheel and under; TRENCHING: Trench Machine Operator, maximum digging capacity 3 ft. depth

GROUP 6: ASPHALT: Plant Oiler; Plant Fireman; Pugmill Operator (any type); Truck mounted asphalt spreader, with screed; BLADE: Blade Operator, pulled type; COMPRESSORS: Compressor Operator (any power), under 1,250 cu. ft. total capacity; CONCRETE: Plant Oiler, Assistant Conveyor Operator; Conveyor Operator; Mixer Box Operator (C.T.B., dry batch, etc.); Cement Hog Operator; Concrete Saw Operator; Concrete Curing Machine Operator (riding type); Wire Mat or Brooming Machine Operator; CRANE: Oiler; Truck Crane Oiler-Driver, 25 tons capacity or over; Fireman, all equipment; A-frame Truck Operator, single drum; Tugger or Coffin Type Hoist Operator; CRUSHER: Crusher Oiler; Crusher Feeder; DRILLING: Drill Tender; Auger Oiler; FLOATING EQUIPMENT: Deckhand; Boatman; FORKLIFT: Self-propelled Scaffolding Operator, construction job site (excluding working platform); Fork Lift or Lumber Stacker Operator, construction job site; GUARDRAIL EQUIPMENT: Oiler,

auger Oiler; Oiler, combination guardrail machines; Guardrail Punch Oiler; HEATING PLANT: Temporary Heating Plant Operator; LOADERS: Bucket Elevator Loader Operator, Barber-Greene and similar types; Bobcat, Skid Steer - Under 1 yd; OILERS: Oiler; Guardrail Punch Oiler; Truck Crane Oiler-Driver, 25 ton or over; Auger Oiler; Grade Oiler, required to check grade; Grade Checker; Tar Pot Fireman; PIPELINE SEWER WATER: Tar Pot Fireman (power agitated); Hydraulic Pipe Press Operator; PUMPS: Pump Operator, under 4"; Pump Operator (any power), 4" and over; Hydrostatic Pump Operator; RAILROAD EQUIPMENT: Brakeman; Oiler; Switchman; Motorman; Ballast Jack Tamper Operator; REPAIRMAN HEAVY DUTY: Parts Man (Tool Room); SHOVEL, DRAGLINE, CLAMSHELL, BACKHOE, SKOOPER OPERATORS: Oiler; Grade Oiler (required to check grade); Grade Checker; Fireman; Signalman; Bell Boy, phones, etc., Operator; Helicopter Radioman (ground); SURFACING (BASE) MATERIAL: Roller Operator, grading of base rock (not asphalt); Tamping Machine Operator, mechanical, self-propelled; Hydrographic Seeder Machine Operator, staw, pulp or seed; SWEEPERS: Broom Operator, self-propelled, construction job site; TRENCHING: Oiler; Grade Oiler (required to check grade); TUNNEL: Conveyor Operator (any type); air Filtration Equipment Operator; Motormen (dinkey); Oiler; WELDING MACHINES: Welding Machine Operator

FOOTNOTE A: HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outline in the specific hazardous waste project site safety plan.

- H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing.
- H-2 Class "C" Suit - Basic hourly wage rate plus \$1.00 per hour, fringes plus \$0.15.
- H-3 Class "B" Suit - Basic hourly wage rate plus \$1.50 per hour, fringes plus \$0.15.
- H-4 Class "A" Suit - Basic hourly wage rate plus \$2.00 per hour, fringes plus \$0.15.

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IRON0086A	07/01/1998	
	Rates	Fringes
IRONWORKERS	22.90	10.17
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LAB00001I	06/01/1998	
	Rates	Fringes
CHELAN AND KITTITAS COUNTIES		
LABORERS:		
ZONE 1:		
GROUP 1	13.44	5.19

GROUP 2	15. 76	5. 19
GROUP 3	17. 48	5. 19
GROUP 4	17. 96	5. 19
GROUP 5	18. 32	5. 19

**ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):**

ZONE 2 - \$ . 70

ZONE 3 - \$1. 00

**BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE,  
AND YAKIMA**

- ZONE 1 - Projects within 25 radius miles of the respective city hall**  
**ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall**  
**ZONE 3 - More than 45 radius miles from the respective city hall**

**CALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary of Wahkiakum County west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES**

**LABORERS:**

**ZONE 1:**

GROUP 1	14. 36	5. 19
GROUP 2	16. 68	5. 19
GROUP 3	21. 36	5. 19
GROUP 4	21. 84	5. 19
GROUP 5	22. 20	5. 19

**ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):**

ZONE 2 - \$ . 70

ZONE 3 - \$1. 00

**BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON**

- ZONE 1 - Projects within 25 radius miles of the respective city hall**  
**ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall**  
**ZONE 3 - More than 45 radius miles from the respective city hall**

**LABORERS CLASSIFICATIONS**

**GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)**

**GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car**

**GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement**

**Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer**

**GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, airtrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Midman; Mortarman and Hodcarrier; Nozzlemann (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunit, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20'); Spreader (concrete); Tamper and Similar electric, air and gas operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer**

**GROUP 5: Caisson Worker; Miner; Powderman; Re-Timberman; Hazardous Waste Worker (Level A).**

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LAB00238I 06/01/1998		
	Rates	Fringes
CHELAN COUNTY		
HOD CARRIERS	19.71	4.39
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LAB00335C 06/01/1998

Rates                      Fringes

PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean)  
COUNTY

ZONE 1:

LABORERS:

GROUP 1	20. 47	6. 14
GROUP 2	20. 87	6. 14
GROUP 3	21. 21	6. 14
GROUP 4	21. 49	6. 14
GROUP 5	18. 73	6. 14
GROUP 6	16. 63	6. 14
GROUP 7	14. 18	6. 14

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Plant Laborers; Asphalt Spreaders; Batch Weighman; Broomers; Brush Burners and Cutters; Car and Truck Loaders; Carpenter Tender; Change-House Man or Dry Shack Man; Choker Setter; Clean-up Laborers; Curing-concrete; Demolition, Wrecking, and Moving Laborers; Dumpers, road oiling crew; Dumpmen (for grading crew); Elevator Feeders; Guard Rail, Median Rail, Reference Post, Guide Post, Right-of-way Marker; Fine Graders; Fire Watch; Form Strippers (not swinging stages); General Laborers; Hazardous Waste Worker; Leverman or Aggregate Spreader (Flaherty and similar types); Loading Spotters; Material Yard Man (including electrical); Pittsburgh Chipper Operator or similar types; Railroad Track Laborers; Ribbon Setters (including steel forms); Rip Rap Man (hand placed); Road Pump Tender; Sewer Laborer; Signalman; Skipman; Slopers; Spraymen; Stake Chaser; Stockpiler; Tie Back Shoring; Timber Faller and Bucker (hand labor); Toolroom Man (at job site); Tunnel Bullgang (above ground); Weight-Man-Crusher (aggregate when used)

GROUP 2: Applicator (including pot power tender for same), applying protective material by hand or nozzle on utility lines or storage tanks on project; Brush (power saw); Burners; Choker Splicer; Clary Power Spreader and similar types; Clean up-nozzlemán-Green cutter (concrete, rock, etc.); Concrete Laborer; Concrete Power Buggyman; Crusher Feeder; Demolition and Wrecking Charred Materials; Gunité Nozzlemán Tender; Gunité or Sand Blasting Pot Tender; Handlers or Mixers of all Materials of an irritating nature (including cement and lime); Pipe Doping & Wrapping; Tool Operators (includes but not limited to: Dry pack machine, Jackhammer, Chipping guns, Paving breakers); Post Hole Digger, air, gas or electric; Vibrating Screed; Tampers; Sand Blasting (wet); Stake-Setter; Tunnel-Muckers, Brakemen, Concrete Crew, Bull gang (Underground)

GROUP 3: Asbestos Removal (structural removal only); Bit Grinder; Drill Doctor; Drill Operators, air tracks cat drills,

wagon drills, rubber-mounted drills, and other similar types; Concrete Saw Operator; Guniting Nozzlemans; High scalers, strippers and drillers (covers work in swinging stages, chairs or belts, under extreme conditions unusual to normal drilling, blasting, barring-down, or sloping and stripping); Manhole Builder; Powdermen; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzlemen; Sand Blasting (dry); Sewer Timberman; Track Liners; Anchor Machines; Ballast Regulators; Multiple Tampers; Power Jacks; Tugger Operator; Tunnel-Chuck Tenders, Nippers and Timbermen; Vibrator; Water Blaster

GROUP 4: Asphalt Raker; Concrete Saw Operator (walls); Concrete Nozzelman; Grade Checker; Pipelayer; Laser Beam (Tunnel) applicable when assigned to move, set up, align laser beam; Miner-Tunnel; Motorman-dinky Locomotive-Tunnel; Powderman-Tunnel; Shield Operator-Tunnel

GROUP 5: Traffic Flaggers

GROUP 6: Fence Builders

GROUP 7: Landscaping and Planting Laborers

#### ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):

ZONE 2 - \$0.65  
 ZONE 3 - 1.15  
 ZONE 4 - 1.70  
 ZONE 5 - 2.75

#### ZONE DEFINITIONS

BASE POINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall  
 ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.  
 ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.  
 ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.  
 ZONE 5: More than 80 miles from the respective city hall.

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PAIN0005A 03/01/1998

Rates Fringes  
 CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS,  
 MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

PAINTERS	21. 11	3. 52
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PAIN0005C 06/10/1996

	Rates	Fringes
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES		

DRYWALL FINSIHERS	23. 00	5. 71
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PAIN0054A 07/01/1998

	Rates	Fringes
CHELAN AND KITTITAS COUNTIES		

PAINTERS:

BRUSH, PAPERHANGER,  
STEAM-CLEANING, STRIPING and  
SPRAY

18. 80	3. 67
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TV, RADIO, ELECTRICAL  
TRANSMISSION TOWERS

20. 39	3. 67
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PAIN0054G 09/01/1998

	Rates	Fringes
CHELAN AND KITTITAS COUNTIES		

GLAZIERS	15. 87	3. 17
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PAIN0054I 06/01/1998

	Rates	Fringes
CHELAN AND KITTITAS COUNTIES		

DRYWALL FINISHER (TAPER)	19. 37	4. 24
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PAIN0055M 02/01/1996

	Rates	Fringes
PACIFIC COUNTY		

DRYWALL FINSIHERS	22. 15	5. 63
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**PAIN0188A 01/01/1999**

**Rates Fringes**  
**CLALLAM, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH**  
**AND THURSTON COUNTIES**

**GLAZIERS 24.25 5.26**  
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**PAIN0188B 07/01/1998**

**Rates Fringes**  
**GRAYS HARBOR AND PACIFIC COUNTIES**

**GLAZIERS 13.35 4.02**  
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**PAIN1238A 06/01/1998**

**Rates Fringes**  
**CALLAM, GRAYS HARBOR, JEFFERSON, LEWIS, MASON, PACIFIC (NORTHERN**  
**PORTION), PIERCE AND THURSTON COUNTIES**

**SOFT FLOOR LAYERS 19.86 5.61**  
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**PAIN1238D 06/01/1998**

**Rates Fringes**  
**KING, KITSAP AND SNOHOMISH COUNTIES**

**SOFT FLOOR LAYERS 21.38 5.63**  
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**PLAS0072C 06/01/1998**

**Rates Fringes**  
**CHELAN AND KITTITAS COUNTIES**

**Zone 1:**  
**CEMENT MASONS 20.24 5.15**

**Zone Differential (Add to Zone 1**  
**rates): Zone 2 - \$2.00**

**BASE POINTS: Spokane, Pasco, Moses Lake, and Lewiston**

**Zone 1: 0 - 45 radius miles from the main post office**  
**Zone 2: 45 radius miles from the main post office**

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**PLAS0082D 06/01/1998**

	<b>Rates</b>	<b>Fringes</b>
<b>PACIFIC (South of a straight line made by extending the north boundary line of Wahkiakum County west to the Pacific Ocean) COUNTY</b>		

<b>PLASTERERS</b>	<b>23. 16</b>	<b>5. 86</b>
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**PLAS0528B 06/01/1998**

	<b>Rates</b>	<b>Fringes</b>
<b>CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum Count, west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES</b>		

<b>CEMENT MASONS</b>	<b>23. 80</b>	<b>7. 89</b>
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**PLUM0032A 06/01/1998**

	<b>Rates</b>	<b>Fringes</b>
<b>CHELAN AND KITTITAS (NORTHERN TIP) COUNTIES</b>		

<b>PLUMBERS AND PIPEFITTERS</b>	<b>23. 47</b>	<b>8. 67</b>
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**PLUM0032B 06/01/1998**

	<b>Rates</b>	<b>Fringes</b>
<b>CLALLAM, KING AND JEFFERSON COUNTIES</b>		

<b>PLUMBERS AND PIPEFITTERS</b>	<b>29. 48</b>	<b>10. 08</b>
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**PLUM0082D 06/01/1997**

	<b>Rates</b>	<b>Fringes</b>
<b>GRAYS HARBOR, LEWIS, MASON (EXCLUDING NE SECTION), PACIFIC, PIERCE AND THURSTON COUNTIES</b>		

<b>PLUMBERS AND PIPEFITTERS</b>		
Total plumbing and piping cost under \$250,000	16. 35	7. 42
Total plumbing and piping cost \$250,000 and over and under \$500,000	22. 05	7. 90
Total plumbing and piping cost		

\$500,000 and over	25.72	9.00
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PLUMD265A 06/01/1997

	Rates	Fringes
SNOHOMISH COUNTY		

PLUMBERS AND PIPEFITTERS:	28.14	9.39
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PLUMD598B 06/01/1998

	Rates	Fringes
KITTITAS (ALL BUT NORTHERN TIP)		

PLUMBERS AND PIPEFITTERS	27.80	9.60
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PLUMD631A 06/01/1997

	Rates	Fringes
MASON (NE SECTION), AND KITSAP COUNTIES		

PLUMBERS/PIPEFITTERS:

All new construction, additions,  
and remodeling of commercial  
building projects such as:  
cocktail lounges and taverns,  
professional buildings, medical  
clinics, retail stores, hotels  
and motels, restaurants and fast  
food types, gasoline service  
stations, and car washes where  
the plumbing and mechanical cost  
of the project is less than  
\$100,000

14.55	7.98
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All other work where the plumbing  
and mechanical cost of the project  
is \$100,000 and over

20.78	12.28
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R00F0054A 06/20/1998

	Rates	Fringes
CLALLAM, JEFFERSON, KING, KITSAP, MASON AND SNOHOMISH COUNTIES		

ROOFERS	23. 30	5. 73
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ROOF0153A 06/01/1998		
	Rates	Fringes
GRAYS HARBOR, LEWIS, PACIFIC, PIERCE AND THURSTON COUNTIES		

ROOFERS	20. 60	5. 84
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ROOF0189A 07/01/1997		
	Rates	Fringes
CHELAN COUNTY		

ROOFERS	17. 00	6. 05
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ROOF0189E 07/01/1997		
	Rates	Fringes
KITTITAS COUNTY		

ROOFERS	17. 60	5. 60
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SFWA0699B 01/01/1999		
	Rates	Fringes
KING, KITSAP, PIERCE, SNOHOMISH AND THURSTON COUNTIES		

SPRINKLER FITTERS	27. 25	10. 05
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SHEE0066D 06/01/1998		
	Rates	Fringes
CHELAN COUNTY		

SHEET METAL WORKERS	22. 55	6. 75
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SHEE0066F 06/01/1998		
	Rates	Fringes
CLALLAM, JEFFERSON, KING, KITSAP, MASON (NORTHERN PORTION) AND SNOHOMISH COUNTIES		

SHEET METAL WORKERS	27. 01	8. 32
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SHEE0066G 06/01/1998

	Rates	Fringes
GRAYS HARBOR, LEWIS, MASON (SOUTHERN PORTION), PACIFIC, PIERCE AND THURSTON COUNTIES		

SHEET METAL WORKERS	26.77	7.91
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SHEE0066M 06/01/1998

	Rates	Fringes
KITTITAS COUNTY		

SHEET METAL WORKERS	23.93	6.87
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WA990002 - 1

TEAM0174B 06/01/1998

	Rates	Fringes
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north		

boundary line of Wahkiakum County west to the Pacific Ocean),  
PIERCE, SNOHOMISH AND THURSTON COUNTIES

## TRUCK DRIVERS:

GROUP 1:	22.45	7.75
GROUP 2:	21.87	7.75
GROUP 3:	19.93	7.75
GROUP 4:	16.30	7.75
GROUP 5:	21.62	7.75

## TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - "A-frame or Hydralift" trucks and Boom trucks or similar equipment when "A" frame or "Hydralift" and Boom truck or similar equipment is used; Buggymobile; Bulk Cement Tanker; Dumpsters and similar equipment, Tournorockers, Tournowagon, Tournotrailer, Cat DW series, Terra Cobra, Le Tourneau, Westinghouse, Athye Wagon, Eucid Two and Four-Wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump Trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with 16 yards to 30 yards capacity: Over 30 yards \$.15 per hour additional for each 10 yard increment; Explosive Truck (field mix) and similar equipment; Hyster Operators (handling bulk loose aggregates); Lowbed and Heavy Duty Trailer; Road Oil Distributor Driver; Spreader, Flaherty Transit mix used exclusively in heavy construction; Water Wagon and Tank Truck-3,000 gallons and over capacity

GROUP 2 - Bulllifts, or similar equipment used in loading or unloading trucks, transporting materials on job site; Dumpsters, and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat. D.W. Series, Terra Cobra, Le Tourneau, Westinghouse, Athye wagon, Euclid two and four-wheeled power tractor with trailer and similar top-loaded equipment transporting material, Dump trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with less than 16 yards capacity; Flatbed: (Dual Rear Axle); Grease Truck, Fuel Truck, Greaser, Battery Service Man and/or Tire Service Man; Leverman and loader at bunkers and batch plants; Oil tank transport; Scissor, Slurry Truck; Sno-Go and similar equipment; Swampers; Straddler Carrier (Ross, Hyster) and similar equipment; Team Driver; Tractor (small rubber-tired (when used within Teamster jurisdiction); Vacuum truck; Water Wagon and Tank trucks-less than 3,000 gallons capacity; Winch truck; Wrecker, tow truck and similar equipment

GROUP 3 - Flatbed: single rear axle; Pickup sweeper, Pickup Truck (Adjust upward by \$2.00 per hour for onsite work)

GROUP 4 - Escort or pilot driver

GROUP 5 - Mechanic

#### HAZMAT PROJECTS

Anyone working on a HAZMAT job, where HAZMAT certification is

required, shall be compensated as a premium, in addition to the classification working in as follows:

LEVEL C: +\$.25 per hour - This level uses an air purifying respirator or additional protective clothing.

LEVEL B: +\$.50 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."

LEVEL A: +\$.75 per hour - This level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

#### ZONE DIFFERENTIAL

Zone pay will be calculated from the city center of the following listed cities:

BELLINGHAM	CENTRALIA	RAYMOND	OLYMPIA
EVERETT	SHELTON	ANACORTES	BELLEVUE
SEATTLE	PORT ANGELES	MT. VERNON	KENT
TACOMA	PORT TOWNSEND	ABERDEEN	BREMERTON

Zone A - 0 - 25 miles - Free Zone  
 Zone B - 25 - 45 miles - \$ .70 per hour  
 Zone C - Over 45 miles - \$1.00 per hour

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TEAM0760F 06/01/1998

EAST OF THE 120TH MERIDIAN: CHELAN AND KITTITAS COUNTIES

(ANYONE WORKING ON HAZMAT  
 JOBS SEE FOOTNOTE A BELOW)

**TRUCK DRIVERS:**

	Rates	Fringes
GROUP 1	18.63	7.06
GROUP 2	21.22	7.06
GROUP 3	21.33	7.06
GROUP 4	21.65	7.06
GROUP 5	21.76	7.06
GROUP 6	21.91	7.06
GROUP 7	22.44	7.06
GROUP 8	22.75	7.06

**TRUCK DRIVERS CLASSIFICATIONS**

**GROUP 1:** Escort Driver or Pilot Car; Employee Haul; Power Boat Hauling Employees or Material

**GROUP 2:** Fish Truck; Flat Bed Truck; Fork Lift (3000 lbs. and under); Trailer Mounted Hydro Seeder and Mulcher; Leverperson (loading trucks at bunkers); Seeder & Mulcher; Stationary Fuel Operator; Tractor (small, rubber-tired, pulling trailer or similar equipment)

**GROUP 3:** Auto Crane (2000 lbs. capacity); Buggy Mobile & Similar; Bulk Cement Tanks & Spreader; Dumptor (6 yds. & under);

Flat Bed Truck with Hydraulic System; Fork Lift (3001-16,000 lbs.); Fuel Truck Driver; Steamcleaner & Washer; Power Operated Sweeper; Rubber-tired Tunnel Jumbo; Scissors Truck; Slurry Truck Driver; Straddle Carrier (Ross, Hyster, & similar); Tireperson; Transit Mixers & Truck Hauling Concrete (3 yd. to & including 6 yds.); Trucks, side, end, bottom and articulated end dump (3 yards to and including 6 yds.); Warehouseperson (to include shipping & receiving); Wrecker & Tow Truck

**GROUP 4:** A-Frame; Burner, Cutter, & Welder; Service Greaser;

Trucks, side, end, bottom and articulated end dump (over 6 yds. to & including 12 yds.); Truck Mounted Hydro Seeder; Warehouseperson; Water Tank truck (0-8000 gallons)

GROUP 5: Dumpster (over 6 yds.); Lowboy (50 tons & under); Self-Loading Roll Off; Semi-Truck & Trailer; Tractor with Steer Trailer; Transit Mixers and Trucks Hauling Concrete (over 6 yds. to and including 10 yds.); Trucks, side, end, bottom and articulated end dump (over 12 yds. to & including 20 yds.); Truck-Mounted Crane (with load bearing surface either mounted or pulled)(up to 14 ton); Vacuum Truck (super sucker, guzzler, etc.)

GROUP 6: Flaherty Spreader Box Driver; Flowboys; Fork Lift (over 16,000 lbs.); Dumps (Semi-end); Lowboy (over 50 tons); Mechanic (Field); Transfer Truck and Trailer; Transit Mixers & Trucks Hauling Concrete (over 10 yds. to & including 20 yds.); Trucks, side, end, bottom and end dump (over 20 yds. to & including 40 yds.); Truck and Pup; Tournarocker, DW's & similar with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater; Water Tank Truck (8,001-14,000 gallons)

GROUP 7: Oil Distributor Driver; Stringer Truck (cable operated trailer); Transit Mixers & Hauling Concrete (over 20 yds.); Truck, side, end, bottom and articulated end dump (over 40 yds. to & including 100 yds.); Truck Mounted Crane (with load bearing surface either mounted or pulled (16 through 25 tons)

GROUP 8: Prime Movers and Stinger Truck; Trucks, side, end, bottom and articulated end dump (over 100 yds.); Helicopter Pilot Hauling Employees or Materials

Footnote A- Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:

- LEVEL D: - \$.25 PER HOUR (This is the lowest level of protection. No respirator is used and skin protection is minimal.
- LEVEL C: - \$.50 PER HOUR (This level uses an air purifying respirator or additional protective clothing.
- LEVEL B: - \$.75 PER HOUR (Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."
- LEVEL A: - \$1.00 PER HOUR (this level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

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WELDERS - Receive rate prescribed for craft performing operation for which welding is incidental.  
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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

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In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U. S. Department of Labor

200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.  
END OF GENERAL DECISION

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## SECTION 01001

### SUPPLEMENTARY REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 DEFINITIONS

The references listed below are to be defined as indicated wherever they may be used in the TECHNICAL SPECIFICATIONS.

"SUPPLEMENTARY REQUIREMENTS " shall be read to pertain to any of the sections of the DIVISION 1 as required by the content of the section or paragraph containing the reference.

Specification "SECTION 01300 – SUBMITTALS" shall be read as a specification "SECTION 01330 – SUBMITTALS".

Specification "SECTION 01400 – CONTRACTOR QUALITY CONTROL" shall be read as a specification "SECTION 01451 – CONTRACTOR QUALITY CONTROL".

##### 1.2 CONSTRUCTION SCHEDULING

The instructions for preparation and submittal of the Contractor-prepared Network Analysis System are found in SECTION 01320, PROJECT SCHEDULE.

##### 1.3 CORRESPONDENCE

1.3.1 All correspondence shall be addressed to the Administrative Contracting Officer, shall be serially numbered commencing with Number 1, with no numbers missing or duplicated and shall be furnished with an original and one copy. Enclosures attached or transmitted with the correspondence shall also be furnished with an original and one copy. Each serial letter shall make reference to the contract name, contract number and shall have only one subject.

1.3.2 All correspondence from the Contracting Officer will be also serially numbered with no numbers missing or duplicated. Letters to the Contractor will be forwarded in duplicate.

1.3.3 In the event there is more than one project within a contract, correspondence shall contain separate and distinct submittals to identify each project by name.

1.3.4 For submission of Contractor payment requests, See Section 01025.

##### 1.4 ADVANCED NOTICE OF CONTRACTOR PERFORMED ACCEPTANCE TESTING

The Contractor shall notify the Contracting Officer a minimum of 20 days prior to performing any acceptance or "buy off" testing of the following systems, (1) EMCS, (2) Fire Detection/Protection, (3) Intrusion Detection System, (4) Uninterruptible Power Supply, (5) HVAC, (6) AFFF, and (7) Hydrant Refuel. Advance notification is not required for testing performed as part of fabrication or installation.

## 1.5 CONTRACTOR'S FILES

Contractor shall maintain "Approved (Action Code "A") and "Approved Except as Noted (Action Code "B") shop drawing files in fabrication shops and at project sites for government use.

## 1.6 AUDIO-VIDEO RECORDINGS

### 1.6.1 General

The Contractor shall provide all equipment, materials, and trained personnel to visually and audibly record (videotape) all on site operations and maintenance (O&M) training sessions for this contract. The video technician shall be employed by a video production company that has been in business for a minimum of 2 years. The Contractor shall submit the resume of the technician and video production company. Also the Contractor shall submit for approval an agenda or an outline breakdown of the proposed presentation. Videotapes shall be produced in the VHS format. Audio shall be adjusted, filtered or otherwise controlled to insure that the trainer can be understood at all times. Each system or piece of equipment shall be covered in a single tape or set of tapes which shall be correlated with the O&M manuals provided. Videotapes and their individual storage cases shall be identified with a typewritten label showing the project, equipment or system, and contract number; this same information shall be provided as an introduction on each video tape. When two or more tapes are provided, they shall be submitted as a set in an appropriate storage container.

### 1.6.2 Submittals

Prior to conducting the training sessions the following shall be submitted for approval:

- 1) A training plan consisting of the agenda or an outline breakdown of the proposed presentation, and
- 2) The qualifications of the trainer and the video recording technician

Two copies of the videotaped material shall be submitted to the Contracting Officer within 10 days after completion of video taping the training sessions.

## 1.7 MECHANICAL AND ELECTRICAL LAYOUT DRAWINGS

The Contractor shall submit, for Contracting Officer's approval, scaled layout drawings, including appropriate elevations and sections, as required, showing the room arrangement the Contractor proposes for all pieces of mechanical and electrical equipment and appurtenances thereto, such as but not limited to: air conditioning equipment, boilers, compressors, hot water tanks, pumps, electrical control panels, ducts and piping, that are to be located in the room. Mechanical and electrical layouts shall be coordinated to eliminate any conflicts of installed equipment. No payments will be made to the Contractor for furnishing or installing equipment until the layout drawings have been approved by the Contracting Officer. Mechanical and electrical equipment layout drawings shall be identified and submitted as specified herein. Equipment rooms shown on the drawings are of adequate size to accommodate equipment of required capacities as available from several manufacturers with sufficient space left for access, servicing, and removal. The use of equipment items with dimensions such as "to crowd the space" will not be permitted.

## 1.9 COLOR BOARDS

Three sets of color boards shall be submitted within 60 calendar days after receipt of Notice to Proceed. The board shall include samples of colors and finishes of every finish such as on walls, floors, and ceilings. This would include, but not be limited to, paint, floor and wall tile, acoustical panels, carpet, wall base, plastic laminate, etc. Where special finishes such as architectural concrete or prefinished metal panels are required, samples of not less than 305 mm (12 inches) square shall be submitted with the board. Boards shall include, where applicable, color samples of integrally colored block, brick, and prefinished metal roofing and siding. The board shall be 610 mm by 610 mm (24 inches by 24 inches). If more space is needed, more than one board per set may be submitted. This is not meant to replace the samples called for in other portions of the specifications. The Contractor shall certify that he has reviewed the color boards in detail and that they are in strict accordance with the contract drawings and specifications, except as may be otherwise explicitly stated.

## 1.10 IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS:

(a) The Contractor shall be responsible for compliance with all regulations and orders of the Commanding Officer of the Military Installation, respecting identification of employees, movements on installation, parking, truck entry, and all other military regulations which may affect the work.

(b) The work under this Contract is to be performed at an operating Military Installation with consequent restrictions on entry and movement of nonmilitary personnel and equipment.

## 1.11 PRESERVATION OF HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES (1985 JAN OCE):

(a) Known historical, archeological and cultural resources within the Contractor's work area are designated on the contract drawings. The Contractor shall install protection for these resources as shown on the drawings and shall be responsible for their preservation during the contract.

(b) If, during construction activities, the Contractor observes items that might have historical or archeological value, such observations shall be reported immediately to the Contracting Officer so that the appropriate authorities may be notified and a determination can be made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in the destruction of these resources and shall prevent his employees from trespassing on, removing, or otherwise damaging such resources.

## 1.12 SPECIAL SAFETY REQUIREMENTS:

All construction activities shall be conducted in strict compliance with the Corps of Engineers Safety and Health Requirements Manual EM 385-1-1, and Occupational Safety and Health Administration regulations, as applicable.

1.12.1 In addition to Safety and Health Requirements Manual EM 385-1-1, and all applicable OSHA standards, the Contractor shall comply with the requirements listed below. Paragraph numbers refer to EM 385-1-1 or are added thereto.

(a) Paragraph 01.A.12: Add new paragraph: Safety Personnel. The Contractor shall designate a person on his staff to manage the Contractor's safety and accident prevention program. This person will provide a point of contact for the Contracting Officer on matters of job safety, and shall be responsible for ensuring the health and safety of on site personnel.

(b) Paragraph 01.D.02, revise as follows:

(1) Replace paragraph 01.D.02c with the following:

"c. Property damage in excess of \$2,000.00

(2) Add new paragraph d as follows:

"An injury resulting in a lost workday, not including the day of injury."

#### 1.13 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (ER 415-1-15 31 OCT 89)

This Paragraph specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE entitled "Default (Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

1.13.1 The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

1.13.2 The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

1.13.3 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

#### MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON (5) DAY WORK WEEK

<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	
10	7	7	4	4	3	1	2	3	6	8	10	Seattle, WA

1.13.4 Upon acknowledgment of the notice to proceed (NTP) and continuing throughout the contract, the contractor will record on the daily QCQ report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delays must prevent work on critical activities for 50 percent or more of the contractor's scheduled workday.

1.13.5 The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 1.14.3, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work

days, and issue a modification in accordance with the contract clause entitled " Default (Fixed Price Construction)".

PARTS 2 AND 3 NOT USED

END OF SECTION



SECTION 01005  
SITE SPECIFIC  
SUPPLEMENTARY REQUIREMENTS

1. CONDUCT OF WORK

1.1 COORDINATION AND ACCESS TO SITE:

1.1.1 Coordination with using agencies shall be made through the Contracting Officer to assist the Contractor in completing the work with a minimum of interference and inconvenience.

1.1.2 All Contractor-owned and privately-owned vehicles require an access pass/vehicle decal. This pass is obtained from Contracting Officer by showing proof of insurance; the vehicle registration; Washington State driver's license; and a letter with original signature of prime Contractor or his superintendent stating the contract name and number, the contract period for which the pass is required, and the employee's name. See Paragraph IDENTIFICATION OF EMPLOYEES AND MILITARY REGULATIONS in SECTION 01001 for specific requirements.

1.1.3 When keys are required for access to facilities on this contract, they shall be obtained through the Contracting Officer.

1.1.3.1 The Contractor shall be responsible for Government-owned keys issued for access to facilities or areas pertinent to this contract.

1.1.3.2 Upon completion of the work in an area, or upon request of the Contracting Officer, the key or keys relevant to the completed areas shall be returned.

1.1.3.3 Should the Contractor lose a key:

(a) the Contracting Officer shall be notified, in writing, within three (3) working days after the loss is discovered and

(b) should the key not be found before final acceptance, the final contract payment shall be reduced by \$100 for each key not returned.

1.1.4 Work hours in the construction area will be restricted to 7:30 a.m. to 4 p.m. daily, Monday through Friday, excluding federal holidays. Work hours other than as specified above shall be coordinated with and approved by the Contracting Officer.

1.1.5 Contractor's workmen shall have on either a uniform with the firm name and the workman's last name or shall have a badge pinned on with both the firm name and the workman's photograph and full name.

## 1.2 UTILITY OUTAGES

Contractor shall coordinate any utility outages with the Contracting Officer at least 7 days in advance. Any utility outages to occur on weekends shall be coordinated at least 14 days in advance. Outages shall be kept to a minimum and any one outage shall not last more than 2 hours.

## 1.3 PROTECTION OF GOVERNMENT PROPERTY

In addition to requirements of the CONTRACT CLAUSES, Contractor shall protect all Government property within the buildings in which he is working, except for such property as is required to be demolished. Property which is to be demolished shall be protected until its scheduled demolition time. Protection shall include, but not be limited to, protection from construction generated dust, debris, water, and vibration.

END OF SECTION



## SECTION 01025

### PAYMENT

#### PART 1 GENERAL

##### 1.1 GENERAL

The contract price for each item shall constitute full compensation for furnishing all plant, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the items in accordance with these specifications and the applicable drawings, including surveying performed by the Contractor. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. No separate payment will be made for the work, services, or operations required by the Contractor, as specified in DIVISION 1, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

##### 1.2 PAYMENT

###### 1.2.1 ITEM 0001 BASE ITEM

Payment will be made at the contract lump sum price for Item No. 0001, All Work for USARC/OMS Phase Two Training Building Within a Line 1.5 Meters Outside the Building Wall Line, Except for Optional Items 0003, 0004 And 0005, payment of which shall constitute full compensation for Item No. 0001, complete.

###### 1.2.2 ITEM 0002 BASE ITEM

Payment will be made at the contract lump sum price for Item No. 0002, All Work for Sitework and Utilities Beyond the Line 1.5 Meters Outside the Building Wall Line, Except Landscaping Shown on Sheet C7.1 and C7.2, payment of which shall constitute full compensation for Item No. 0002, complete.

###### 1.2.3 ITEM 0003 OPTIONAL ITEM

Payment will be made at the contract lump sum price for Item No. 0003, All Work for Loading Dock Extension, payment of which shall constitute full compensation for Item No. 0003, complete.

#### 1.2.4 ITEM 0004 OPTIONAL ITEM

Payment will be made at the contract lump sum price for Item No. 0004, All Work for Landscaping as Shown on Sheet C7.1, payment of which shall constitute full compensation for Item No. 0004, complete.

#### 1.2.5 ITEM 0005 OPTIONAL ITEM

Payment will be made at the contract lump sum price for Item No. 0005, All Work for Landscaping as Shown on Sheet C7.2, payment of which shall constitute full compensation for Item No. 0005, complete.

### 1.3 PROGRESS PAYMENT INVOICE

Requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

1.3.1 When submitting payment requests, the Contractor shall complete Blocks 1 through 12 of the "PROGRESS PAYMENT INVOICE" Form as directed by the Contracting Officer. (A sample form is attached at the end of this Technical Specification Section.) The completed form shall then become the cover document to which all other support data shall be attached.

1.3.2 One additional copy of the entire request for payment, to include the "PROGRESS PAYMENT INVOICE" cover document, shall be forwarded to a separate address as designated by the Contracting Officer.

1.3.3 The Contractor shall submit with each pay request, a list of subcontractors that have worked during that pay period. The listing shall be broken down into weeks, identifying each subcontractor that has worked during a particular week, and indicate the total number of employees that have worked on site for each subcontractor for each week. The prime Contractor shall also indicate the total number of employees for its on site staff for each week.

PARTS 2 and 3 NOT USED

**PROGRESS PAYMENT INVOICE**

See Federal Acquisition Regulations (FAR) 32.900, 52.232-5, & 52.232-27

1. PROJECT AND LOCATION	2. DATE
3. CONTRACTOR NAME AND ADDRESS (Must be the same as in the Contract)	4. CONTRACT NO.  5. INVOICE NO.
6. DESCRIPTION OF WORK	7. PERIOD OF PERFORMANCE  From:  To:
8. DISCOUNT TERMS	
9. OFFICIAL TO WHOM PAYMENT IS TO BE FORWARDED Name: Title: Phone: ( ) -	10. OFFICIAL TO BE NOTIFIED OF DEFECTIVE INVOICE Name: Title: Phone ( ) -
<b>11. CERTIFICATION: I hereby certify, to the best of my knowledge and belief, that</b> (1) The amounts requested are only for the performance in accordance with the specifications, terms, and conditions of this contract; (2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of Chapter 39 of Title 31, United States Code; and (3) This request for progress payment does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.	
<div style="display: flex; justify-content: space-between;"> <span>_____ (Signature)</span> <span>_____ (Title)</span> <span>_____ (Date)</span> </div>	
12. OTHER INFORMATION OR DOCUMENTATION required by Contract. Provide two (2) copies of each (check and attach if applicable):  <input type="checkbox"/> Updated Progress Chart/Schedule <input type="checkbox"/> Progress Narrative <input type="checkbox"/> Certified Payrolls (submitted weekly) <input type="checkbox"/> Safety Exposure Report <input type="checkbox"/> Updated Submittal Register <input type="checkbox"/> Progress Photos <input type="checkbox"/> Subcontractor/Employee Listings	(FOR GOVERNMENT USE ONLY)  Retainage: ____%    Amt: \$_____  Withholdings: \$ _____  Reason: _____  Following items are current: As-Builts        ____ Yes    ____ No O & M Manuals   ____ Yes    ____ No 1354 Data        ____ Yes    ____ No Submittal Register ____ Yes    ____ No

END OF SECTION

END OF SECTION

## SECTION 01061

### ENVIRONMENTAL PROTECTION

#### PART 1 GENERAL

##### 1.1 SCOPE

This Section covers prevention of environmental pollution and damage as the result of construction operations under this contract. For the purpose of this specification, environmental pollution, and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for esthetic, cultural, and/or historical purposes. The control of environment pollution and damage requires consideration of air, water, and land, and includes management of visual esthetics, noise, and solid waste, as well as other pollutants.

##### 1.2 QUALITY CONTROL

The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record any problems in complying with laws, regulations, and ordinances, and corrective action taken.

###### 1.2.1 Subcontractors

Assurance of compliance with this Section by subcontractors will be the responsibility of the Contractor.

##### 1.3 NOTIFICATION

When the Contracting Officer notifies the Contractor in writing of any observed noncompliance with Federal, state, or local laws, regulations, or permits, the Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or costs or damage allowed to the Contractor for any such suspension.

##### 1.4 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications. Environmental protection shall be as stated in the following subparagraphs:

###### 1.4.1 Protection of Land Resources

The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from the Contracting Officer except as

otherwise specified or indicated. See Paragraph 1.5 for additional requirements relating to protection of trees during excavation in the vicinity of a tree.

#### 1.4.2 Disposal of Garbage

Garbage shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination.

#### 1.4.3 Refuse Disposal and Cleanup

Refuse shall be defined as debris other than such organic materials as brush or tree stumps.

##### 1.4.3.1 Refuse Disposal

The cost of refuse disposal, such as transportation, handling, dumping fees as applicable, and similar cost, shall be included in the contract price. Refuse shall be disposed of off site, in accordance with all local, state, and Federal rules and regulations, at the Contractor's expense.

##### 1.4.3.2 Fire Hazard

Cloths, cotton waste, and other combustible materials that might constitute a fire hazard shall be placed in closed metal containers and placed outside or destroyed at the end of each day.

#### 1.4.4 Restrictions

The Contractor will not be permitted to deposit refuse in existing garbage cans or refuse dumpsters. Cleaners shall not be poured, drained, or washed into plumbing fixtures or sanitary or storm sewers. Debris, dirt, dust, and stains attributable to or resulting from the work effort shall be removed, cleaned, or effaced by the Contractor to the satisfaction of the Contracting Officer prior to acceptance of the job. Refuse shall not be burned. Burning of vegetation or tree stumps will not be allowed unless the worksite is in an area approved for burning.

### 1.5 PROTECTION OF TREES DURING EXCAVATION

Care shall be exercised by the contractor when excavating trenches in the vicinity of trees. Where roots are 51 mm (2 inches) in diameter or greater, the trench shall be excavated by hand and tunneled. When large roots are exposed, they shall be wrapped with a heavy burlap for protection and to prevent drying. Trenches dug by machines adjacent to trees having roots less than 51 mm (2 inches) in diameter shall have the sides hand trimmed making a clean cut of the roots. Trenches having exposed tree roots shall be backfilled within 24 hours unless adequately protected by moist burlap or canvas.

### 1.6 MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

## 1.7 RESTORATION OF LANDSCAPE (VEGETATION - SUCH AS TREES, PLANTS, AND GRASS) DAMAGE

All landscape features (vegetation - such as trees, plants, and grass) damaged or destroyed during Contractor operations outside and within the work areas shall be restored to a condition similar to that which existed prior to construction activities unless otherwise indicated on the drawings or in the specifications. This restoration shall be done at no additional cost to the Government. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

Trees shall be replaced in kind with a minimum 102 mm (4-inch) caliper nursery stock. Shrubs, vines, and ground cover shall be replaced in kind; size to be approved by the Contracting Officer.

All plant material shall meet specifications outlined in ANSI Z60.1 - current publication, "American Standard for Nursery Stock."

Grass areas shall be replaced in kind by sodding or seeding. Sod shall be required in all regularly maintained lawn areas and shall be installed according to American Sod Producers Association Guideline Specifications to Sodding.

Grass seeding shall be installed on a minimum 2-inch topsoil and as recommended by the local county extension service.

END OF SECTION





SECTION 01320  
PROJECT SCHEDULE

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTALS:

SD-07 Schedules

GA Preliminary project schedule, two (2) copies.

GA initial project schedule, two (2) copies  
Activity No. Sort  
Predecessor/successor listing  
Cost Schedule  
Floppy Disk (SDEF Format)  
Activity Code Dictionary.

FIO Periodic schedules updates, monthly updates two (2) copies.  
Floppy Disks (SDEF Format)  
Narrative  
Activity No. Sort  
Cost Schedule

SD-08 Statements

Qualifications; GA.

Documentation showing qualifications of personnel preparing schedule reports.

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project should also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

### 3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel shall result in an inability of the Contracting Officer to evaluate Contractor progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

### 3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification including the SDEF (Standard Data Exchange Format). Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

#### 3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in Precedence Diagram Method (PDM)

#### 3.3.2 Level of Detail Required

With the exception of the initial and preliminary schedule submission, the Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule.

### 3.3.2.1 Activity Durations

Contractor submissions shall be required to follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods. A rule of thumb, that the Contractor should use, is that less than 2 percent of all non-procurement activities' Original Durations shall be greater than 20 days.

### 3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.

### 3.3.2.3 Government Activities

Government and other agencies activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.

### 3.3.2.4 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, (at the lowest tier), Contractor work force, or Government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

### 3.3.2.5 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

### 3.3.2.6 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number.

### 3.3.2.7 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

### 3.3.2.8 (Not used)

### 3.3.2.9 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited to, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

### 3.3.2.10 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

### 3.3.3 Scheduled Project Completion

The schedule interval shall extend from notice-to-proceed to the contract completion date.

#### 3.3.3.1 Project Start Date

The schedule shall start no earlier than the date that the Notice to Proceed (NTP) was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have: an "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

#### 3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity call "End Project". The "End Project" activity shall have: an "LF" constraint, a constraint date equal to the completion date for the project, and a zero day duration.

#### 3.3.3.3 Early Project Completion

In the event the project schedule shows completion, the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted at every project schedule update period to assist the Contracting Officer to evaluate the Contractor's ability to actually complete prior to the contract period.

#### 3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

### 3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in progress or completed activity and insure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

### 3.3.6 Out-of-Sequence Progress

Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) shall be allowed only by the case-by-case approval of the Contracting Officer. The Contracting Officer may direct that changes in schedule logic be made to correct any or all out-of-sequence work.

### 3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

## 3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

### 3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 10 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after Notice to Proceed.

### 3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after Notice to Proceed. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

### 3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative, is necessary for verifying the contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

### 3.4.4 Standard Activity Coding Dictionary

The Contractor shall submit, with the Initial Project Schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code Value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once approved with the Initial Project Schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer.

## 3.5 SUBMISSION REQUIREMENTS

The as noted in paragraph 1.1 items shall be submitted by the Contractor for the initial submission, and every periodic project schedule update throughout the life of the project:

### 3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall be in the format specified in paragraph 3.10 NAS DATA.

#### 3.5.1.1 File Medium

Required data shall be submitted on 89 mm (3.5 inch) disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5.0 operating system.

#### 3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the MS-DOS version used to format the disk.

#### 3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will insure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

### 3.5.2 Narrative Report

A Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the critical path, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken.

### 3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

### 3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in-progress or completed.

#### 3.5.4.1 Activity Report

A list of all activities sorted according to activity number. For completed activities the Actual Start Date shall be used as the secondary sort.

#### 3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

#### 3.5.4.3 Total Float Report

A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

#### 3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the Notice to Proceed until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), Earnings to Date.

### 3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on quarterly update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

#### 3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity or event number, description, duration, and estimated earned value shall be shown on the diagram.

#### 3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

#### 3.5.5.3 Critical Path

The critical path shall be clearly shown.

#### 3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

#### 3.5.5.5 S-Curves

Earnings curves shall be provided showing projected early and late earnings and earnings to date.

### 3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly on-site meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor will describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

#### 3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

#### 3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

#### 3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost to Date shall be subject to the approval of the Contracting Officer. The following minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meeting.



#### 3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed activities.

#### 3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations must be based on Remaining Duration for each activity.

#### 3.6.3.3 Cost Completion

The earnings for each activity started. Payment shall be based on earnings for each in-progress or completed activity. Payment for individual activities shall not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

#### 3.6.3.4 Logic Changes

All logic changes pertaining to Notice to Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

#### 3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities are those delays beyond the Contractors control such as strikes and unusual weather. Also included are delays encountered due to submittals, Government Activities, deliveries or work stoppage which makes re-planning the work necessary, and when the schedule does not represent the actual prosecution and progress of the work.

### 3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

#### 3.7.1 Justification of Delay

The project schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension, shall be based upon the project schedule updates in effect for the time period in question and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, shall not be a cause for a time extension to the contract completion date.

### 3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under two weeks based upon the most recent schedule update at the time of the Notice to Proceed or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

### 3.7.3 Additional Submission Requirements

For any request for time extension for over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

## 3.8 DIRECTED CHANGES

If Notice to Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until the Contractor submits revisions, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, then the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor will continue to update their schedule with the Contracting Officer's revisions until a mutual agreement in the revisions may be made. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

## 3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

### 3.10 NAS DATA

The Contractor shall provide the Government with the means to electronically transfer all required NAS data into its ADP equipment and schedule software, such that it can independently obtain and process the information. The Contractor may use network analysis software different from that used by the Contracting Officer in the Resident Office. Under this alternative, the Contractor shall furnish the following:

NAS data that complies with the Scheduling System Data Exchange Format (SDEF). This is a standard ASCII format for exchanging scheduling data and is compatible with our resident management system. Many software developers are using SDEF. The SDEF specifications are in a separate publication, available from the Internet [WWW.CECER.AARMY.MIL/PL/SDEF](http://WWW.CECER.AARMY.MIL/PL/SDEF).

END OF SECTION



## SECTION 01330

### SUBMITTAL PROCEDURES

#### PART 1 GENERAL

##### 1.1 CONTROL AND SCHEDULING OF SUBMITTALS

###### 1.1.1 Submittal Coordination Meeting

After the preconstruction conference and before any submittals are sent to the Contracting Officer's Representative (COR), with the exception of Division 1 submittals, the Contractor shall meet with the COR to develop an approved preliminary submittal register, ENG Form 4288. During the meeting all required items will be identified and grouped into three categories:

- Government Approved (GA)

Government approval is required for extensions of design, critical materials, variations/deviations, an "or equal" decision, equipment whose compatibility with the entire system must be checked, architectural items such as Color Charts/Patterns/Textures, and other items as designated by the COR. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will be acted on as "shop drawings."

- For Information Only (FIO)

Submittals not requiring Government approval will be for information only. These are items such as Installation Procedures, Certificates of compliance, Samples, Qualifications, etc. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," these submittals will not be acted on as "shop drawings."

- Those items that can be visually inspected by the Contractor's Quality Control Representative (CQC) on site or are provided to the Government other than with an ENG Form 4025: The items that fall into this category shall remain on the register but shall not be submitted to the COR. For these items, the "Classification" column on the submittal register shall remain blank.

###### 1.1.2 Final Submittal Register

The final submittal register shall be coordinated with the progress schedule and submitted within 40 days of Notice to Proceed. In preparing the final document, adequate time (minimum of 30 days) shall be allowed for review and approval, and possible resubmittal of each item on the register.

###### 1.1.3 Submittal Register Updates

The Contractor's quality control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listings shall be submitted to the COR at least every 30 days in the quantity specified.

## 1.2 SUBMITTAL TYPES

Throughout these specifications submittals may be identified with the prefix "SD" (submittal data) followed by a number (category, i.e., data, drawings, reports, etc.). This is for bookkeeping and record sorting in the system:

### SD-01 Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

### SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

### SD-06 Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

### SD-07 Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

### SD-08 Statements

A document, required of the Contractor, or through the Contractor from a subcontractor, supplier, installer, or manufacturer to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other quality verifications.

### SD-09 Reports

Reports of inspections or tests, including analyses and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

### SD-13 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer that a product, system or material meets specified requirements. The statement must be dated after the award of this contract and state the Contractor's name and address, project and location, and list specific requirements which are being certified.

### SD-14 Samples

Fabricated and/or unfabricated physical examples of materials, products, and/or units of work as complete units or as portions of units.

#### SD-18 Records

Documentation to record compliance with technical or administrative requirements.

#### SD-19 Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

Submittals required by the Contract Clauses and other non-technical parts of the contract are not necessarily included in this section. These type of submittals can be added to the register before or during the submittal coordination meeting.

### 1.3 APPROVED SUBMITTALS

The approval of submittals by the COR shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist. The Contractor, under the CQC requirements of this contract, is responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. After submittals have been approved by the COR, no resubmittal for the purpose of substituting materials or equipment will be given consideration.

### 1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the COR and promptly furnish a corrected submittal in the format and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, written notice, as required under the Contract Clause entitled "Changes," shall be given to the COR.

### 1.5 PAYMENT

Separate payment will not be made for submittals, and all costs associated therein shall be included in the applicable unit prices or lump sum prices contained in the schedule. Payment will not be made for any material or equipment which does not comply with contract requirements.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

Prior to submittal, all items shall be checked and approved by the Contractor's CQC and each item of the submittal shall be stamped, signed, and dated. Each respective transmittal form (ENG Form 4025) shall be signed and dated by the CQC certifying that the accompanying submittal complies with the contract requirements. This procedure applies to all submittals. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including, but not limited to,

catalog cuts, diagrams; operating charts or curves; test reports; test cylinders; samples; O&M manuals including parts lists; certifications; warranties and other such required items. Units of weights and measures used on all submittals shall be the same as the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. GA submittals shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. The COR may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. The Contractor shall maintain a complete and up-to-date file of all submittals/items on site for use by both the Contractor and the Government.

### 3.2 SUBMITTAL REGISTER (ENG Form 4288)

The Contractor shall approve all items listed on the submittal register. The ENG Form 4288 in APPENDIX A immediately following this specification Section lists each item of equipment and material for which submittals are required. During the submittal coordination meeting, a preliminary submittal register will be created by annotating this Form 4288. When the final submittal register is submitted for approval, the Contractor shall complete the column entitled "Item No." and all data under "Contractor Schedule Dates" and return five completed copies to the COR for approval. The Contractor shall review the list to ensure its completeness and may expand general category listings to show individual entries for each item. The numbers in column "Item No." are to be assigned sequentially starting with "1" for each specification section. DO NOT preassign transmittal numbers when preparing the submittal register. When a conflict exists between the submittal register and a submittal requirement in the technical sections, other than those submittals referenced in Paragraph 3.9: Field Test Reports, the approved submittal register shall govern. The preliminary, and then the final approved submittal register, will become the scheduling documents and will be updated monthly and used to control submittals throughout the life of the contract. Names and titles of individuals authorized by the Contractor to approve shop drawings shall be submitted to COR with the final 4288 form. Supplier or subcontractors certifications are not acceptable as meeting this requirement.

### 3.3 SCHEDULING

Submittals covering component items forming a system, or items that are interrelated, shall be coordinated and submitted concurrently. Certifications shall be submitted together with other pertinent information and/or drawings. Additional processing time beyond 30 days, or number of copies, may be shown by the COR on the submittal register attached in the "Remarks" column, or may be added by the COR during the coordination meeting. No delays, damages or time extensions will be allowed for time lost due to the Contractor not properly scheduling and providing submittals.

### 3.4 TRANSMITTAL FORM (ENG Form 4025)

Transmittal Form 4025 (sample at end of this section) shall be used for submitting both GA and FIO submittals in accordance with the instructions on the reverse side of the form. Transmittal numbers shall be assigned sequentially. Electronic generated 4025 forms shall be printed on carbonless paper and be a reasonable facsimile of the original 4025. If electronic forms are not used, the original 4025 forms shall be used (do not photo copy) and will be furnished by the COR. These forms shall be filled in completely prior to submittal. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.. Each submittal item shall be listed separately on the form, naming subcontractor, supplier, or manufacturer, applicable specification paragraph number(s), drawing/sheet number, pay item number, and any other information



needed to identify the item, define its use, and locate it in the work. One or more 4025 forms may be used per specification section, however, DO NOT include more than one specification section per transmittal.

### 3.5 CROSS-REFERENCE (ENG FORM 4288/ENG FORM 4025)

To provide a cross-reference between the approved submittal register and transmittal forms, the Contractor shall record the "transmittal numbers" assigned when submitting items in column "Transmittal No." of the ENG FORM 4288. The item numbers in column "Item No." of submittal register shall correspond to the item numbers on ENG Form 4025.

### 3.6 SUBMITTAL PROCEDURE

#### 3.6.1 General

Shop drawings with 4025 forms shall be submitted in the number of copies specified in subparagraphs "Government Approved Submittals" and "Information Only Submittals," or as indicated on the submittal register in the "Remarks" column. Submit a complete collated "reviewers copy" with one 4025 form and attachments (not originals). The remaining copies (4 for GA, 2 for FIO) of 4025 forms and attachments shall not be collated. This would not apply to a series of drawings.

#### 3.6.2 Approval of Submittals by the Contractor

Before submittal to the COR, the Contractor shall review and correct shop drawings prepared by subcontractors, suppliers, and itself, for completeness and compliance with plans and specifications. The Contractor shall not use red markings for correcting material to be submitted. Red markings are reserved for COR's use. Approval by the Contractor shall be indicated on each shop drawing by an approval stamp containing information as shown in this section. Submittals not conforming to the requirements of this section will be returned to the Contractor for correction and resubmittal.

#### 3.6.3 Variations

For submittals which include proposed variations requested by the Contractor, column "h" of ENG Form 4025 shall be checked and the submittal shall be classified as GA, and submitted accordingly. The Contractor shall set forth in writing the justification for any variations and annotate such variations on the transmittal form in the REMARKS block. Variations are not approved unless there is an advantage to the Government. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

#### 3.6.4 Drawings

Each drawing shall be not larger than A1 size (841 mm wide by 594 mm high), with a title block in lower right hand corner and a 75 mm by 100 mm (3 by 4 inch) clear area adjacent. The title block shall contain the subcontractor's or fabricator's name, contract number, description of item(s), bid item number, and a revision block. Provide a blank margin of 20 mm (3/4 inch) at bottom, 50 mm (2 inches) at left, and 10 mm (1/2 inch) at top and right. Where drawings are submitted for assemblies of more than one piece of equipment or systems of components dependent on each other for compatible characteristics, complete information shall be submitted on all such related components at the same time. The Contractor shall ensure that information is complete and that sequence of drawing submittal is such that all information is available for reviewing each drawing. Drawings for all items and equipment, of special manufacture or

fabrication, shall consist of complete assembly and detail drawings. All revisions after initial submittal shall be shown by number, date, and subject in revision block.

#### 3.6.4.1 Submittals Containing Drawings Larger than A3 size (297 mm high by 420 mm wide)

For GA submittals containing drawings larger than A3 size, one reproducible and one blue line copy will be required to be submitted with five copies of the ENG Form 4025. The marked-up reproducible (and/or any review comments contained on the page-size comment sheet(s) at the Government's option) will be returned to the Contractor upon review. Three copies of blue line drawings (generated from the reviewed reproducible) will be provided to the Government within 10 days of Contractor's receipt of the reviewed reproducible. The Contractor shall not incorporate approved work into the project until the Government has received the three blue line copies. The Contractor shall use the marked-up reproducible to make any additional copies as needed. For FIO submittals, one reproducible and two blue line copies will be required to be submitted with the appropriate number of copies of ENG Form 4025.

#### 3.6.5 Printed Material

All requirements for shop drawings shall apply to catalog cuts, illustrations, printed specifications, or other data submitted, except that the 75 mm by 100 mm (3 inch by 4 inch) clear area adjacent to the title block is not mandatory. Inapplicable portions shall be marked out and applicable items such as model numbers, sizes, and accessories shall be indicated by arrow or highlighted.

### 3.7 SAMPLES REQUIRING LABORATORY ANALYSIS

See Section CONTRACTOR QUALITY CONTROL for procedures and address for samples requiring Government testing.

### 3.8 SAMPLES REQUIRING VISUAL INSPECTION

Samples requiring only physical inspection for appearance and suitability shall be coordinated with the on-site Government quality assurance representative (QAR).

### 3.9 FIELD TEST REPORTS

Routine tests such as soil density, concrete deliveries, repetitive pressure testing shall be delivered to the QAR with the daily Quality Control reports. See SECTION: CONTRACTOR QUALITY CONTROL.

### 3.10 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

### 3.11 GOVERNMENT APPROVED SUBMITTALS (GA)

The Contractor shall submit 5 copies of GA submittals with 5 corresponding 4025 forms. Upon completion of GA submittal review, copies as specified below will be marked with an action code, dated, and returned to the Contractor. See "Drawings" above for special instructions if drawings larger than size A3 (11 inch by 17 inch) are used.

#### 3.11.1 Processing of GA Submittals

Submittals will be reviewed and processed as follows:

- a. Approved as Submitted (Action Code "A"): Shop drawings which can be approved without correction will be stamped "Approved" and two copies will be returned to the Contractor. No resubmittal required.
- b. Approved Except as Noted (Action Code "B"): Shop drawings which have only minor discrepancies will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted" and two copies returned to the Contractor for correction. No resubmittal required.
- c. Approved Except as Noted (Action Code "C"): Shop drawings which are incomplete or require more than minor corrections will be annotated in red to indicate necessary corrections. Marked material will be stamped "Approved Except as Noted - Resubmission Required" and two copies returned to the Contractor for correction. Resubmittal of only those items needing correction required.
- d. Disapproved (Action Code "E"): Shop drawings which are fundamentally in error, cover wrong equipment or construction, or require extensive corrections, will be returned to the Contractor stamped "Disapproved." An explanation will be furnished on the submitted material or on ENG Form 4025 indicating reason for disapproval. Complete resubmittal required.
- e. Resubmittal will not be required for shop drawings stamped "A" or "B" unless subsequent changes are made by Contractor or a contract modification. For shop drawings stamped "C" or "E," Contractor shall make corrections required, note any changes by dating the revisions to correspond with the change request date, and promptly resubmit the corrected material. Resubmittals shall be associated with the "parent" by use of sequential alpha characters (for example, resubmittal of transmittal 8 will be 8A, 8B, etc). Government costs incurred after the first resubmittal may be charged to the Contractor.

### 3.12 INFORMATION ONLY SUBMITTALS (FIO)

The Contractor shall submit three copies of data and four copies of ENG Form 4025. FIO submittals will not be returned. Government approval is not required on FIO submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the Contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the COR from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

#### 3.12.1 Processing of FIO Submittals

FIO submittals shall be submitted prior to delivery of the material or equipment to the job site. ENG Form 4025 shall be marked with the words "contractor approved - information copy only" in the REMARKS block of the form. Submittals will be monitored and spot checks made. When such checks indicate noncompliance, the Contractor will be notified by the same method used for GA submittals. Resubmittal of nonconforming FIO submittals shall be reclassified GA and shall be in five copies.

### 3.13 CONTRACTOR APPROVAL STAMP

The stamp used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR:
CONTRACT NUMBER _____
TRANSMITTAL NUMBER _____
ITEM NUMBER _____
SPECIFICATION SECTION _____
PARAGRAPH NUMBER _____
_____ APPROVED AS SUBMITTED
_____ APPROVED WITH CORRECTIONS AS NOTED
SIGNATURE: _____
TITLE: _____
DATE _____

CONTRACTORS REVIEW STAMP

MAXIMUM SIZE:

3 INCHES BY 3 INCHES

01330-9

INSTRUCTIONS

DACA 67-99-B-0024

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A --	Approved as submitted.	E --	Disapproved (See attached).
B --	Approved, except as noted on drawings.	F --	Receipt acknowledged.
C --	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX --	Receipt acknowledged, does not comply as noted with contract requirements.
D --	Will be returned by separate correspondence.	G --	Other (Specify)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG Form 4025-R)

## APPENDIX A

### SUBMITTAL REGISTER

(ENG FORM 4288)

INSERT

COMPLETED ENG FORMS 4288

HERE

IN THE FINAL DOCUMENT



SUBMITTAL REGISTER																									
ER414-1-10																									
Title and Location															Contractor							Contract Number			
(99020) USARC/TRAININ (99020) USARC/TRAINING PHASE 2, FT. LAWTON, WA															Specification Section							Specification Section			
Transmittal No.	Item No.	Specification Paragraph Number	Description of Item Submitted	Type of Submittal										Classification		Reviewer	Contractor Schedule Dates			Contractor Action			Government Action		Remarks
				Data	Drawing	Instructions	Schedules	Statements	Reports	Certifications	Samples	Records	Info. Only	Govt. Approv.	Submit		Approval Needed By	Material Needed By	Code	Date	Submit to Government	Code	Date		
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
			COLOR BOARD											X											
			SECTION 01001																						
		1.2	CONSTRUCTION PROGRESS CHART	X			X							X											
		1.6	TRAINING VIDEO			X								X											
		1.7	LAYOUT DRAWING		X									X											
		1.8	COLOR BOARD								X														
			SECTION 01026																						
		1.3	PROGRESS PAYMENT INVOICE					X																	
			SECTION 01036																						
		1.1	PROPOSED MOD PRICE					X																	
			SECTION 01300																						
		3.2	SUBMITTAL REGISTER	X										X											
		3.4	TRANSMITTAL FORM	X																					
			SECTION 01400																						
		3.2	QC PLAN					X						X											
			SECTION 01501																						
		1.3.3	TEMP. POWER CONNECTION		X									X											
			SECTION 01701																						
		1.1	O & M MANUALS	X		X		X						X											

# SUBMITTAL REGISTER

Title and Location	Contractor	Contract Number
(99020) USARC/TRAINING PHASE 2, FT. LAWTON, WA		Specification Section

[illegible]

SUBMITTAL REGISTER																									
ER414-1-10																									
Title and Location															Contractor						Contract Number				
(99020) USARC/TRAINING PHASE 2, FT. LAWTON, WA																					Specification Section				
Trans- mittal No.	Item No.	Specification Paragraph Number	Description of Item Submitted	Type of Submittal										Classi- fication			Contractor Schdule Dates			Contractor Action			Government Action		Remarks
				Data	Drawing	Instructions	Schedules	Statements	Reports	Certifications	Samples	Records	Info. Only	Govnt. Approv.	Reviewer		Submit	Approval Needed By	Material Needed By	Code	Date	Submit to Govern- ment	Code	Date	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		2050 1.3.A	Work Plan detailing the procedures proposed for accomplishment of the work				X																		
		2225 1.3.A	Earthwork, Location for disposal of unused satisfactory material. Proposed source of borrow material					X																	
		2232 1.3.A	Equipment					X																	
		2232 1.3.B	Sampling and Testing - Reports						X															QC REPORT	
		2232 1.3.C	Sampling and Testing - Laboratory					X																INCLUDED IN CQC PLAN	
		2275 1.4.A	Temporary Erosion Control Plan										X												
		2554 1.3.A	Test Results for Bituminous Paving Materials																					QC REPORT	
		2560 1.1.A	Test Reports						X															QC REPORT	
		2560 1.1.B	Waybills and Delivery Tickets									X												QC REPORT	
		2580 1.3	Certificate from Marking Material Manufacturer											X											
		2581 1.3	Certificate from Sign Manufacturer											X											
		2660 1.5.A	Manufacturer's Certificates and Catalog Cuts											X											
		2711 1.4.A	Certifications from Manufacturer											X											
		2720 1.4.A	Certified Copies of Test Reports											X											
		2730 1.4.A	Manufacturer's Certificates and Catalog Cuts											X											
		2811 1.5.A	Record Drawings of Existing wiring, Utilities, etc		X																			AS BUILT'	
		2831 1.2.A	Certificate of Materials for Fencing Materials									X		X											
		2835 1.3	Certificate of Materials for Guardrail Materials								X		X												

SUBMITTAL REGISTER																									
ER414-1-10																									
Title and Location															Contractor							Contract Number			
(99020) USARC/TRAINING PHASE 2, FT. LAWTON, WA																						Specification Section			
Trans- mittal No.	Item No.	Specification Paragraph Number	Description of Item Submitted	Type of Submittal										Classi- fication			Contractor Schdule Dates			Contractor Action			Government Action		Remarks
				Data	Drawing	Instructions	Schedules	Statements	Reports	Certifications	Samples	Records	Info. Only	Govnt. Approv.	Reviewer		Submit	Approval Needed By	Material Needed By	Code	Date	Submit to Govern- ment	Code	Date	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		2950 1.7.D	Furnish Certificates of Inspection and Compliance					X					X												
		2950 1.7.E	Submit Samples of Plant material								X														
		3300 1.9.A	Reinforced CIP Concrete Shop Drawings		X																				
		4100 1.4.A	Design Mix	X																					
		4100 1.4.B	Samples								X														
		4100 1.4.C	Mortar Reports						X																
		4100 1.4.D	Grout Reports						X																
		4100 1.4.E	Manufacturer's Certificate							X			X												
		4255 1.4.A	Product Design Data	X										X											
		4255 1.4.B	Shop Drawings		X								X												
		4255 1.4.C	Samples								X			X											
		4270 1.4.B	Product Data	X									X												
		4270 1.7.B	Samples								X		X												
		4270 1.4.D	Manufacturer's Installation Instructions			X							X												
													X												

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				Data	Drawing	Instructions	Schedules	Statements	Reports	Certifications	Samples	Records	Info. Only	Govt. Approv.	Submit	Approval Needed By	Material Needed By		Code	Date	Submit to Government	Code	Date				
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y			
		4270 1.4.B	Product Data	X									X														
		4270 1.7.B	Samples								X		X														
		4270 1.4.D	Manufacturer's Installation Instructions			X							X														
		4311 1.5.A	Product Data	X										X													
		4311 1.5.B	Samples								X		X														
		4311 1.5.C	Manufacturer's Certificate							X																	
		4320 1.5.A	Product Data for Veneer Masonry Units	X																							
		4320 1.5.B	Samples of Brick Panel								X																
		4320 1.5.C	Manufacturer's Certificate	X									X														
		4340 1.6.A	Shop Drawings		X																						
		4340 1.6.B	Product Data	X																							
		4340 1.6.C	Samples								X																
		4340 1.6.D	Manufacturer's Certificate							X			X														

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y			
		5120 1.6.A	Shop Drawings		X									X													
		5120 1.6.B	Welding Procedure			X								X													
		5120 1.6.C	Mill Test Reports						X					X													
		5120 1.6.D	Manufacturer's Mill Certificate							X				X													
		5120 1.6.E	Welder's Certificate							X				X													
		5120 1.6.F	Surveys											X													
		5120 1.6.G	Proofs of Compliance for Materials									X		X													
		5120 1.6.H	Manufacturer's Literature	X										X													
		5120 1.6.I	Inspection Reports						X					X													
		5120 1.6.J	Certificate of Quality Assurance Program						X					X													
		5210 1.7.A	Product Data	X										X													
		5210 1.7.B	Shop Drawings		X									X													
		5210 1.7.C	Welder's Certificate							X				X													
		5311 1.7.A	Shop Drawings		X																						
		5311 1.7.B	Product Data	X																							
		5311 1.7.C	Manufacturer's Installation Instructions			X																					

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		5313 1.6.A	Shop Drawings		X										X										
		5313 1.6.B	Mill Test Reports	X																					
		5313 16C	Product Data	X																					
		5313 1.6.D	Manufacturers Installation Instructions																						
		5400 1.6.A	Shop Drawings		X																				
		5400 1.6.B	Calculations	X																					
		5400 16C	Product Data	X																					
		5500 1.4.A	Shop Drawings		X																				
		5510 1.5.A	Shop Drawings		X										X										
		6182 1.5B	Product Data	X																					
		6182 1.5.C	Shop Drawings		X										X										
		6200 1.5.A	Shop Drawings		X										X										
		6200 1.5.B	Hardware Instruction			X																			

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		7120 1.5.A	Shop Drawings		X									X											
		7120 1.5.B	Product Data	X																					
		7120 1.5.C	Manufacturers Installation Instructions			X																			
		7120 1.5.D	Manufacturers Certificate							X															
		7160 1.4.A	Product Data	X																					
		7160 1.4.B	Manufacturer's Installation Instructions			X																			
		7191 1.7.B	Product Data	X																					
		7191 1.7.C	Manufacturer's Installation Instructions			X																			
		7212 1.5.A	Product Data	X																					
		7212 1.5.B	Manufacturer's Installation Instructions			X																			
		7212 1.5.C	Manufacturer's Certificate							X			X												
		7212 1.5.D	Sample								X														
		7213 1.5.A	Product Data	X																					
		7213 1.5.B	Manufacturer's Certificate							X			X												
		7270 1.5.A	Shop Drawings		X																				
		7270 1.5.B	Manufacturer's Data	X									X												
		7270 1..5.C	Applicator's Qualifications Statement							X															





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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		7416 1.7.A	Design Analysis						X					X											
		7416 1.7.B	Calculation						X					X											
		7416 1.7.C	Shop drawings		X									X											
		7416 1.7.D	Qualifications							X			X												
		7416 1.7.E	Tests						X					X											
		7416 1.7.F	Certificates							X			X												
		7416 1.7.G	Samples								X			X											
		7465 1.6.A	Shop drawings		X																				
		7465 1.6.B	Samples								X														
		7710 1.4.A	Shop drawings		X																				
		7710 1.4.B	Product Data	X																					
		7710 1.4.C	Samples								X														
		7710 1.4.D	Manufacturer's Installation Instructions			X																			
		7900 1.4.A	Product Data	X																					
		7900 1.4.B	Samples								X														
		7900 1.4.C	Manufacturer's Installation Instructions			X																			

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		8111 1.4.A	Shop Drawings		X																				
		8111 1.4.B	Product Data	X																					
		8111 1.4.C	Manufacturer's Installation Instructions			X																			
		8111 1.4.D	Manufacturer's Certificate							X				X											
		8112 1.4.A	Shop Drawings																						
		8112 1.4.B	Product Data	X																					
		8112 1.4.C	Samples								X														
		8112 1.4.D	Manufacturer's Installation Instructions			X																			
		8112 1.4.E	Manufacturer's Certificate							X				X											
		8211 1.4.A	Shop Drawings		X										X										
		8211 1.4.B	Product Data	X										X											
		8211 1.4.C	Samples								X				X										
		8211 1.4.D	Manufacturer's Installation Instructions			X								X											
		8331 1.6.A	Product Data	X										X											
		8331 1.6.B	Shop Drawings		X									X											
		8331 1.6.C	Samples								X														
		8331 1.6.D	Manufacturer's Instructions			X								X											

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		8332 1.6.A	Operation and Maintenance Data	X										X											
		8332 1.6.B	Maintenance Data	X																					
		8410 1.8.A	Shop Drawings		X									X										INCLUDED IN OTHER SECTIONS	
		8410 1.8.B	Product Data	X																					
		8410 1.8.C	Samples								X														
		8410 18.D	Manufactureus Certificate							X															
		8450 1.5.B	Product Data	X																					
		8450 1.5.C	Shop Drawings		X									X											
		8450 1.5.D	Samples								X														
																								INCLUDE IN COLOR BOARD	

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		8710 1.5.A	Shop Drawings		X									X											
		8710 1.5.B	Manufacturer's Data	X										X											
		8710 1.5.C	Samples								X														
																								INCLUDED IN OTHER SECTIONS	
		8800 1.5.A	Product Data on Glass Types	X																					
		8800 1.5.B	Product Data on Glazing Compounds	X																					
		8800 1.5.C	Samples																						
		8921 1.7.B	Test Reports						X																
		8921 1.7.C	Installation Data	X																					
		9111 1.5.A	Shop Drawings		X									X											
		9111 1.5.B	Product Data	X																					
		9111 1.5.C	Manufacturer's Installation Instructions			X																			
																								INCLUDE IN COLOR BOARD	

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		9206 1.5.A	Product Data	X																					
		9260 1.5.A	Shop Drawings		X									X											
		9260 1.5.B	Produst Data	X																				INCLUDED IN OTHER SECTIONS	
		9306 1.4.A	Shop Drawings		X									X											
		9306 1.4.B	Product Data	X																					
		9306 1.4.C	Samples								X														
		9306 1.4.D	Manufacturer's Certificate							X															
				X																					
		9307 1.4.A	Shop Drawings		X									X											
		9307 1.4.B	Product Data	X																					
		9307 1.4.C	Samples								X														
		9307 1.4.D	Manufacturer's Data	X																					
		9511 1.5.A	Shop Drawings		X																			INCLUDE IN COLOR BOARD	
		9511 1.5.B	Product Data	X																					
		9511 1.5.C	Samples								X														
		9511 1.5.D	Manufacturers Installation Instructions			X																			

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		9520 1.5.A	Shop Drawings		X									X											
		9520 1.5.B	Manufacturer's Data	X																					
																								COLOR BOARDS	
		9650 1.4.A	Shop Drawings		X									X											
		9650 1.4.B	Product Data	X																					
		9650 1.4.C	Samples								X														
		9650 1.4.D	Manufacturer's Installation Instructions			X																		COLOR BOARDS	
		9651 1.4.A	Shop Drawings		X																				
		9651 1.4.B	Product Data	X																					
		9651 1.4.C	Samples								X													COLOR BOARDS	
		9651 1.4.D	Manufacturer's Installation Instructions			X																			
		9688 1.4.A	Shop Drawings		X																				
		9688 1.4.B	Product Data	X																					
		9688 1.4.C	Samples								X													COLOR BOARDS	
		9688 1.4.D	Manufacturer's Installation Instructions			X																			
		9690 1.4.A	Shop Drawings		X																				
		9690 1.4.C	Samples								X			X											
		9690 1.4.D	Manufacturer's Installation Instructions			X																			

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		9900 1.5.A	Product Data	X									X												
		9900 1.5.B	Samples								X		X												
		9900 1.5.C	Manufacturer's Instructiions			X							X												
		10105 1.4.A	Shop Drawings		X									X											
		10105 1.4.B	Product Data	X																					
		10105 1.4.C	Samples								X														
		10160 1.4.A	Shop Drawings		X									X											
		10160 1.4.B	Product Data	X																					
		10160 1.4.C	Samples								X														
		10160 1.4.D	Manufacturers Installation Instructions			X																			
		10211 1.5.A	Shop Drawings		X									X											
		10211 1.5.B	Product Data	X									X												
		10211 1.5.C	Samples								X			X											
		10211 1.5.D	Manufacturer's Certificate							X			X												
		10440 1.4.A	Manufacturer's Catalog Data	X									X												
		10440 1.4.B	Shop Drawings		X						X			X											
		10440 1.4.C	Manufacturer's Certificate										X												
		10440 1.4.D	Samples								X			X											



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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y
		10508 1.4.A	Product Data	X									X											
		10508 1.4.B	Shop Drawings		X									X										
		10508 1.4.C	Samples								X													
		10522 1.4.A	Shop Drawings		X																			
		10522 1.4.B	Product Data	X																				
		10522 1.4.C	Manufacturer's Installation Instructiions			X																		
		10522 1.4.D	Manufacturer's Certificate							X			X											
		10552 1.3.A	Shop Drawings		X									X										
		10552 1.3.B	Samples								X													
		10552 1.3.C	Seismic Calculations					X																
		10553 1.3.A	Shop Drawings		X									X										
		10553 1.3.B	Product Data	X																				
		10553 1.3.C	Samples								X													
		10553 1.3.D	Manufacturers Installation Instructions			x																		
		10553 1.3.E	Manufacturers Certificate							X														

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		10605 1.4.A	Shop Drawings		X									X											
		10605 1.4.B	Product Data	X									X												
		10605 1.4.C	Samples								X			X											
		10605 1.4.D	Manufacturer's Installation Instructions			X							X												
		10651 1.5.A	Shop Drawings		X									X											
		10651 1.5.B	Product Data	X																					
		10651 1.5.C	Samples								X														
		10651 1.5.D	Manufacturer's Installation Instructions			X																		COLOR BOARDS	
		10651 1.5.E	Manufacturer's Certificate							X															
		10753 1.4.A	Shop Drawings		X									X											
		10753 1.4.B	Product Data		X																				
		10800 1.4.A	Product Data	X																					
		10800 1.4.B	Samples								X													COLOR BOARDS	
		10800 1.4.C	Manufacturer's Installation Instructions			X																			

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		11132 1.4.A	Product Data	X									X												
		11132 1.4.B	Shop Drawings		X									X											
		11133 1.4.A	Product Data	X									X												
		11133 1.4.B	Shop Drawings		X									X											
		11165 1.3.A	Product Data	X									X												
		11165 1.3.B	Manufacturers Installation Instructions			X																			
																								COLOR BOARDS	
		11400 1.3.A	Shop Drawings		X									X											
		11400 1.3.B	Rough-In Drawings		X								X												
		11400 1.3.C	Manufacturers Data	X									X												
		11470 1.6.A	Shop Drawings		X									X											
		11470 1.6.B	Samples								X		X												
																								COLOR BOARDS	

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		11471 1.4.A	Shop Drawings		X									X											
		11471 1.4.B	Product Data	X									X												
		11471 1.4.C	Samples								X														
		11471 1.4.D	Manufacturers Installation Instructions			X						X													
		11471 1.4.E	Manufacturers Certificate							X				1											
		12512 1.5.A	Shop Drawings		X									X											
		12512 1.5.B	Product Data	X									X												
		12512 1.5.C	Samples								X		X											COLOR BOARDS	
		12512 1.5.D	Manufacturers Installation Instructions			X						X													
		14245 1.8.A	Shop Drawings		X									X											
		14245 1.8.B	Product Data	X									X												
		14245 1.8.C	Samples								X		X												
																								COLOR BOARDS	

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15121 1.5.B	Product Data	X										X											
		15121 1.5.C	Welder's Certificates							X				X											
		15121 1.5.D	Manufacturer's Installation Instructions			X								X											
		15140 1.7.B	Shop Drawings		X										X										
		15140 1.7.C	Product Data	X											X										
		15140 1.7.D	Design Data	X											X										
		15140 1.7.E	Manufacturer's Installation Instructions			X								X											
		15140 1.7.F	Welder's Certificates							X				X											
		15140 1.7.G	Pipe Hanger Schedule				X							X											
		15170 1.4.B	Product Data	X											X										
		15170 1.4.C	Test Reports						X					X											
		15170 1.4.D	Manufacturer's Installation Instructions			X								X											
		15170 1.5.B	Operation and Maintenance Data	X										X											
		15190 1.5.B	Identification Material and Device				X								X										
		15190 1.5.C	Valve Schedule				X							X											
		15190 1.5.D	Product Data	X											X										
		15190 1.5.E	Manufacturer's Installation Instructions			X								X											
		15190 1.6.A	Project Record Documents		X									X											

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15245 1.7.B	Shop Drawings		X									X											
		15245 1.7.C	Product Data	X										X											
		15245 1.7.D	Manufacturer's Installation Instructions			X							X												
		15245 1.7.E	Manufacturer's Certificate							X			X												
		15245 1.7.F	Maintenance Data	X									X												
		15245 1.8.A	Project Record Documents		X								X												
		15260 1.5.B	Product Data	X										X											
		15260 1.5.C	Material Certificates							X			X												
		15260 1.5.D	Test Reports						X				X												
		15260 1.5.E	Manufacturer's Installation Instructions			X							X												
		15280 1.5.B	Product Data	X										X											
		15280 1.5.C	Material Certificates							X			X												
		15280 1.5.D	Test Reports						X				X												
		15280 1.5.E	Manufacturer's Installation Instructions			X							X												
		15290 1.5.B	Product Data	X										X											
		15290 1.5.C	Material Certificates							X			X												
		15290 1.5.D	Test Reports						X				X												
		15290 1.5.E	Manufacturer's Installation Instructions			X							X												

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15330 1.3.A	Load Calculations for Sizing Sway Bracing	X										X											
		15330 1.3.B	Sprinkler System Equipment	X										X											
		15330 1.3.C	Hydraulic Calculations	X										X											
		15330 1.3.D	Spare Parts	X										X											
		15330 1.3.E	Sprinkler System Shop Drawings		X									X											
		15330 1.3.F	Project Record Documents		X								X												
		15330 1.3.G	Test Procedures			X								X											
		15330 1.3.H	Preliminary Tests				X							X											
		15330 1.3.I	Final Test				X							X											
		15330 1.3.J	Installer Qualifications					X						X											
		15330 1.3.K	Submittal Preparer's Qualifications					X						X											
		15330 1.3.L	Material and Test Certificates							X			X												
		15330 1.3.M	Operation and Maintenance Data	X									X												
		15410 1.4.A	Product Data	X										X											
		15410 1.5.A	Project Record Documents		X									X											
		15410 1.5.C	Operation and Maintenance Data	X									X												

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15430 1.5.A	Shop Drawings		X									X											
		15430 1.5.B	Product Data	X										X											
		15430 1.5.C	Manufacturer's Installation Instructions			X							X												
		15430 1.5.D	Manufacturer's Certificate							X			X												
		15430 1.6.A	Project Record Documents		X								X												
		15430 1.7.A	Operation and Maintenance Data	X									X												
		15440 1.6.A	Product Data	X										X											
		15440 1.6.B	Manufacturer's Installation Instructions			X							X												
		15440 1.7.A	Operation and Maintenance Data	X									X												
		15450 1.4.A	Shop Drawings		X									X											
		15450 1.4.B	Product Data	X										X											
		15450 1.4.C	Manufacturer's Installation Instructions			X							X												
		15450 1.5.A	Operation and Maintenance Data	X									X												
		15510 1.5.A	Product Data	X										X											
		15510 1.5.B	Welder's Certificate							X				X											
		15510 1.5.C	Manufacturer's Installation Instructions			X							X												
		15510 1.6.A	Project Record Documents		X								X												
		15510 1.7.A	Operation and Maintenance Data	X									X												



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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15515 1.4.A	Product Data	X										X											
		15515 1.4.B	Inspection Certificate							X			X												
		15515 1.4.C	Manufacturer's Installation Instructions			X							X												
		15515 1.5.A	Project Record Documents		X								X												
		15515 1.6.A	Operation and Maintenance Data	X									X												
		15540 1.5.A	Product Data	X										X											
		15540 1.5.B	Manufacturer's Installation Instructions			X							X												
		15540 1.5.C	Millwright's Certificate							X			X												
		15540 1.6.A	Operation and Maintenance Data	X									X												
		15545 1.6.A	Shop Drawings		X									X											
		15545 1.6.B	Product Data	X										X											
		15545 1.6.C	Manufacturer's Installation Instructions			X							X												
		15545 1.6.E	Manufacturer's Field Reports						X				X												
		15545 1.6.F	Certificate							X			X												
		15545 1.7.A	Project Record Documents		X								X												
		15545 1.8.A	Operation and Maintenance Data	X									X												

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15556 1.4.A	Product Data	X										X											
		15556 1.4.B	Shop Drawings		X									X											
		15556 1.4.C	Manufacturer's Installation Instructions			X								X											
		15556 1.4.D	Factory Test Reports						X					X											
		15556 1.4.E	Manufacturer's Field Reports						X					X											
		15556 1.4.G	Operation and Maintenance Data	X										X											
		15556 1.4.H	Wiring Diagrams		X									X											
		15575 1.6.A	Shop Drawings		X									X											
		15575 1.6.B	Product Data	X										X											
		15575 1.6.C	Manufacturer's Installation Instructions			X								X											
		15682 1.4.A	Shop Drawings		X									X											
		15682 1.4.B	Product Data	X										X											
		15682 1.4.C	Certification							X				X											
		15682 1.4.D	Manufacturer's Installation Instructions			X								X											
		15682 1.4.E	Operation and Maintenance Data	X										X											
		15790 1.4.A	Shop Drawings		X									X											
		15790 1.4.B	Product Data	X										X											
		15790 1.4.C	Manufacturer's Installation Instructions			X								X											
		15790 1.4.D	Certificate							X				X											

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15835 1.5.A	Shop Drawings		X									X											
		15835 1.5.B	Product Data	X										X											
		15835 1.5.C	Schedules				X							X											
		15835 1.5.D	Service Location		X									X											
		15835 1.5.E	Manufacturer's Installation Instructions			X								X											
		15835 1.6.A	Project Record Documents		X									X											
		15835 1.6.A	Operation and Maintenance Data	X										X											
		15850 1.5.A	Product Data	X										X											
		15850 1.6.A	Operation and Maintenance Data	X										X											
		15855 1.5.A	Shop Drawings		X									X											
		15855 1.5.B	Product Data	X										X											
		15855 1.5.C	Manufacturer's Installation Instructions			X								X											
		15855 1.6.A	Operation and Maintenance Data	X										X											
		15870 1.4.A	Product Data	X										X											
		15870 1.4.B	Manufacturer's Installation Instructions			X								X											
		15870 1.5.A	Operation and Maintenance Data	X										X											

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15890 1.6.A	Shop Drawings		X									X											
		15890 1.6.B	Product Data	X										X											
		15890 1.6.C	Test Reports						X				X												
		15890 1.6.D	Manufacturer's Installation Instructions			X							X												
		15890 1.7.A	Project Record Documents		X								X												
		15910 1.4.A	Shop Drawings		X									X											
		15910 1.4.B	Product Data	X										X											
		15910 1.4.C	Manufacturer's Installation Instructions			X							X												
		15910 1.5.A	Project Record Documents		X								X												
		15920 1.6.A	Shop Drawings		X									X										1	
		15920 1.6.B	Product Data	X										X											
		15920 1.6.C	Design Data	X										X											
		15920 1.6.D	Test Reports						X				X												
		15920 1.6.E	Manufacturer's Installation Instructions			X							X												
		15920 1.6.F	Manufacturer's Field Reports						X				X												
		15920 1.7.A	Project Record Documents		X								X												

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15930 1.6.A	Shop Drawings		X									X											
		15930 1.6.B	Product Data	X										X											
		15930 1.6.C	Schedule				X							X											
		15930 1.6.D	Manufacturer's Installation Instructions			X							X												
		15930 1.7.A	Project Record Documents		X								X												
		15930 1.8.A	Operation and Maintenance Data	X									X												
		15940 1.4.A	Product Data	X										X											
		15940 1.5.A	Project Record Documents		X								X												
		15950 1.3.A	Control System Data	X									X												
		15950 1.3.B	Training			X							X												
		15950 1.3.D	Control System Drawings		X									X											
		15950 1.3.F	Wiring Diagram		X									X											
		15950 1.3.H	Sequence of Operation		X									X											
		15950 1.3.I	Valve Schedule				X							X											
		15950 1.3.J	Damper Schedule				X							X											
		15950 1.3.K	Service Organization Instructions			X							X												
		15950 1.3.L	Testing, Commissioning and Balancing Reports						X				X												
		15950 1.3.N	Operation and Maintenance Data	X									X												
		15950 1.3.O	Commissioning Procedures			X							X												

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		15980 1.5.A	Product Data	X										X											
		15980 1.5.B	Product Certificates							X				X											
		15980 1.5.C	Operation and Maintenance Data	X										X											
		15980 1.5.D	Manufacturer's Installation Instructions			X								X											
		15980 1.7.A	Project Record Documents		X									X											
		15990 1.5.A	Agency	X										X											
		15990 1.5.B	Field Reports							X				X											
		15990 1.5.C	Data Reports							X				X											
		15990 1.5.D	Draft Reports							X				X											
		15990 1.5.E	Final Reports							X				X											
		15990 1.5.F	Test Reports							X				X											
		15990 1.5.G	Calibration Reports							X				X											
		15990 1.6.A	Project Record Documents		X									X											

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y
		16010 1.13.A	All Equipment	X																				
		16030 3.02.A	General Test						X															BALANCING REPORT
		16030 3.02.B	Test Reports and Records						X															BALANCING REPORT
		16030 3.02.C	Conductor Tests						X															BALANCING REPORT
		16030 3.02.D	Low-Voltage Distribution Switchboard Tests						X															BALANCING REPORT
		16030 3.03	Demonstration of Electrical Systems			X																		BALANCING REPORT
		16030 3.03.D	Completion of Work and Record						X															BALANCING REPORT
		16030 3.04	Certificate of Completion							X														
		16030 3.05	Instruction Operating Personnel			X																		
		16050 Part 2	Products	X																				
		16111 1.4.A	Data Sheets	X																				

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a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		16118 1.04.A	Manufacturer's Data	X									X												
		16123 1.4.A	Data Sheets	X																					
		16123 1.4.B	Megger Tests Reports						X																
		16123 1.4.C	Manufacturer's Installation Instructions			X																			
		16130 1.4.A	Data Sheets	X																					
		16140 1.4.A	Data Sheets	X																					
		16140 1.4.B	Manufacturer's Installation Instructions			X																			
		16170 1.6.A	Data Sheets	X																					
		16170 1.6.B	Test Reports						X																
		16170 1.6.C	Manufacturer's Instructions			X																			
		16190 1.4.A	Product Data	X																					
		16190 1.4.B	Manufacturer's Instructions			X																			
		16191 1.4.A	Data Sheets	X									X												
		16191 1.4.B	Shop Drawings		X								X												
		16191 1.4.C	Calculations									X	X												
		16191 1.4.D	Manufacturer's Instructions			X							X												
		16195 1.4.A	Product Data	X																					
		16195 1.4.B	Manufacturer's Instructions			X																			



SUBMITTAL REGISTER																									
ER414-1-10																									
Title and Location																Contractor								Contract Number	
(99020) USARC/TRAINING PHASE 2, FT. LAWTON, WA																								Specification Section	
Transmittal No.	Item No.	Specification Paragraph Number	Description of Item Submitted	Type of Submittal										Classification		Reviewer	Contractor Schdule Dates			Contractor Action			Government Action		Remarks
				Data	Drawing	Instructions	Schedules	Statements	Reports	Certifications	Samples	Records	Info. Only	Govnt. Approv.	Submit		Approval Needed By	Material Needed By	Code	Date	Submit to Government	Code	Date		
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	
		16421 1.5.A	All Metering Equipment									X	X												
		16425 1.04.A	Product Data	X										X											
		16425 1.04.B	Shop Drawings		X									X											
		16425 1.04.C	Manufacturer's Instructions			X								X											
		16441 1.4.A	Data Sheets	X																					
		16441 1.4.B	Manufacturer's Instructions			X																			
		16470 1.4.A	Data Sheets	X									X												
		16470 1.4.B	Manufacturer's Installation Instructions			X							X												
		16476 1.4.A	Data Sheets	X																				PANEL BOARD	
		16476 1.4.B	Manufacturer's Installation Instructions			X																		PANEL BOARD	
		16481 1.4.A	Data Sheets	X									X												
		16481 1.4.B	Manufacturer's Installation Instructions			X							X												
		16510 1.043A	Product Data	X									X												
		16510 1.03.B	Shop Drawings		X								X												
		16510 1.03.C	Manufacturer's Installation Instructions			X							X												
		16511 1.4.A	Data Sheets	X									X												
		16511 1.4.B	Manufacturer's Instructions			X							X												
		16511 1.4.C	Manufacturer's Instructions			X							X												



## SECTION 01415

### METRIC MEASUREMENTS

#### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 380 (1993) Practice for Use of the International System of Units (SI)

ASTM E 621 (1994) Practice for Use of Metric (SI) Units in Building Design and Construction

#### 1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. A number of circumstances require that both metric SI units and English inch-pound (I-P) units be included in a section of the specifications. When both metric and I-P measurements are included, the section may contain measurements for products that are manufactured to I-P dimensions and then expressed in mathematically converted metric value (soft metric) or, it may contain measurements for products that are manufactured to an industry recognized rounded metric (hard metric) dimensions but are allowed to be substituted by I-P products to comply with the law. Dual measurements are also included to indicate industry and/or Government standards, test values or other controlling factors, such as the code requirements where I-P values are needed for clarity or to trace back to the referenced standards, test values or codes. For American Society for Testing and Materials (ASTM) references in the technical specifications, the Contractor shall use the metric publication, if one is available (For example: ASTM A 36, use ASTM A 36M). An acceptable substitute to hard Metric SI Concrete Masonry Units (CMU) and Recessed Lighting Fixtures (RLF) is English in-pound (soft metric) CMU and RLF. The Contractor shall be responsible for any adjustments required to accommodate these alternative English in-pound units at no additional cost to the Government.

#### 1.3 USE OF MEASUREMENTS

Measurements shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. The Contractor shall be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

##### 1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value, i.e., where an SI value is not an exact mathematical conversion of an I-P value, such as the use of 100 mm in lieu of 4 inches. Hard metric products are required when only metric dimensions are indicated, except for Contractor's options as outlined in paragraph GENERAL above. Hard metric measurements are often used for field data such as distance from one point to another or distance above the floor. Products are

considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

### 1.3.2 Soft Metric

a. A soft metric measurement is indicated by an SI value which is a mathematical conversion of the I-P value shown in parentheses e.g. 38.1 mm (1-1/2 inches). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.

b. A soft metric measurement is also indicated for products that are manufactured in industry designated metric dimensions but are required by law to allow substitute I-P products. These measurements are indicated by a manufacturing hard metric product dimension followed by the substitute I-P equivalent value in parentheses e.g., 190 x 190 x 390 mm (7-5/8 x 7-5/8 x 15-5/8 inches).

### 1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g., American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

## 1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

## 1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM E 380 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals.

END OF SECTION

## SECTION 01451

### CONTRACTOR QUALITY CONTROL

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
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ASTM E 329	(1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
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##### 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

## 3.2 QUALITY CONTROL PLAN

### 3.2.1 General

The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

### 3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

### 3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 5 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

## 3.4 QUALITY CONTROL ORGANIZATION

### 3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

### 3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 5 years construction experience on construction similar to this contract or a construction person with a minimum of 10 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

### 3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, civil, structural, architectural, materials technician, submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.

	<b>Experience Matrix</b>	
	<b><u>Area</u></b>	<b><u>Qualifications</u></b>
a.	Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 years related experience
b	Mechanical	Graduate Mechanical Engineer with 2 years experience or person with 5 years related experience
c.	Electrical	Graduate Electrical Engineer with 2 years related experience or person with 5 years related experience
d	Structural	Graduate Structural Engineer with 2 years experience or person with 5 years related experience
e.	Architectural	Graduate Architect with 2 years experience or person with 5 years related experience
f.	Submittals	Submittal Clerk with 1 year experience
g.	Concrete, Pavements and Soils	Materials Technician with 2 years experience for the appropriate area



#### 3.4.4 Additional Requirement

In addition to the above experience education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered at AGC offices throughout the state of Washington and Oregon.

#### 3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

### 3.5 SUBMITTALS

Submittals shall be made as specified in Section SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

### 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

#### 3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### 3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be

conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements, see Table 1 – Minimum Testing, attached at the end of this specification section. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2 Testing Laboratories

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Costs of testing the Contractor Laboratory facilities for Government acceptance shall be borne by the Contractor. Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. All personnel performing concrete testing shall be certified by the American Concrete Institute (ACI). The contractor shall submit documentation showing the AALA, or other approved testing facility, certification, personnel ACI certifications, and the name and work experience of the Registered Professional Engineer on the staff.

#### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

#### 3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

U.S. Army Corps of Engineers  
Materials Testing Center  
Waterways Experiment Station  
3909 Hall Ferry Road  
Vicksburg, MS 39180-6199  
Phone: (610) 634-3974

ATTN: Project \_\_\_\_\_, Contract Number \_\_\_\_\_

Coordination for each specific test, exact delivery location and dates will be made through the Area Office.

If samples are scheduled to arrive at the laboratory on a weekend (after 1700 Friday through Sunday) notify the laboratory at least 24 hours in advance at (601) 634-3974 to arrange for delivery.

### 3.8 COMPLETION INSPECTION

#### 3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

#### 3.8.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

#### 3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

### 3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals reviewed, with contract reference, by whom, and action taken.
- g. Off-site surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### 3.10 SAMPLE FORMS

Sample forms are attached at the end of this specification section.

### 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

### 3.12 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM FOR CONTRACTOR QUALITY CONTROL OF CONTRACT

The Contractor shall utilize a Government furnished Contracting Quality Control (CQC) Programming Module (a computerized executable file which is DOS based and operates on a minimum 80386 IBM compatible computer). The Module includes a Daily CQC Reporting System form which must also be used. This form may be in addition to other Contractor desired reporting forms. However, all other such reporting forms shall be consolidated into this one Government specified Daily CQC Report Form. The Contractor will also be required to complete Government-Furnished Module elements which include, but are not limited to, Prime Contractor staffing; letter codes; planned cumulative progress earnings; subcontractor information showing trade, name, address, point-of-contact, and insurance expiration dates; definable features of work; pay activity and activity information; required Quality Control tests tied to individual activities; planned User Schooling tied to specific specification paragraphs and Contractor activities; and Transfer Property Listing. The Contractor shall also enter and expand (as necessary) the following submittal data as provided in the solicitation documents: submittal information relating to specification section, description, activity number, review period and expected procurement period. The sum of all activity values shall equal the contract amount, and all Bid Items, The sum of all activity values shall equal the contract amount, and all Bid Items, Options and Additives shall be separately identified, in accordance with the "Bidding Schedule". Bid Items may include multiple Activities, but Activities may only be assigned to one such Bid Item. This Module shall be completed to the satisfaction of the Contracting Officer prior to any contract payment (except for Bonds, Insurance and/or Mobilization, as approved by the Contracting Officer), and shall be updated as required.

3.12.1 During the course of the contract, the Contractor will receive various Quality Assurance comments from the Government that will reflect corrections needed to Contractor activities or reflect outstanding or future items needing the attention of the Contractor. The Contractor shall acknowledge receipt of these comments by specific number reference on his Daily CQC Report, and shall also reflect on his Daily CQC Report when these items are specifically completed or corrected to permit Government verification.

3.12.2 The Contractor's schedule system shall include, as specific and separate activities, all Preparatory Phase Meetings (inspections); all O&M Manuals; and all Test Plans of Electrical and Mechanical Equipment or Systems that require validation testing or instructions to Government representatives.

TABLE 1  
MINIMUM SAMPLING AND TESTING FREQUENCY

<u>Materials</u>	<u>Test</u>	<u>Minimum Sampling and Testing Frequency</u>
<u>Fills, Embankments, Backfills, Subgrade, Subbase, and Base Course Material</u>		
Fill and Embankment	Field Density <sup>2/12/</sup>	Two tests per lift for each increment or fraction of 1,672 square meters (2000 sy) and any time material type changes.
	Lab Density <sup>3/</sup>	One test initially per each type of materials or blended material and any time material type changes, and one every 10 field density tests.
	Gradation <sup>1/</sup>	One test every 153 cubic meters (200 cubic yards) of fill for each type of materials or blended material and any time material type changes.
Subgrade	Field Density <sup>2/12/</sup>	One test per each increment or fraction of 84 square meters (100 s.y.)
	Lab Density <sup>3/</sup>	One test every 10 field density tests.
Backfill for Culverts, Trenches, Buildings and Walls, Pavements, and Other Structures	Field Density <sup>2/12/</sup>	Culverts: One test per each lift.
		Trenches: One test per lift for each increment or fraction of 152 lineal meters (500 linear feet) for backfill. Under pavements, one test every lift and at every crossing.



TABLE 1 (con.)

<u>Materials</u>	<u>Test</u>	<u>Minimum Sampling and Testing Frequency</u>
		Walls and Buildings Perimeters, Including Footings: One test per lift for each increment or fraction of 61 lineal meters (200 linear feet) of backfill.
		Buildings Slabs on Grade: One test per lift for each increment or fraction of 93 square meters (1000 s.f.)
		Areas enclosed by grade beams, compacted with power driven hand operated compactors: One test per lift for each increment or fraction of 46 square meters (500 s.f.)
		Pavements: Two tests per lift for each increment or fraction of 1,672 square meters (2000 s.y.)
		Other Structures: One test per lift for each increment or fraction of 61 lineal meters (200 linear feet) of backfill.
	Lab Density <sup>3/</sup>	One test initially per each type of material or blended material and one every 10 field density tests.
	Gradation <sup>1/</sup>	One test per each type of material or blended material and one every 10 field density tests.
Subbase and Base	Gradation <sup>1/</sup> (including .02 mm particles size limits.	1 sample for every 3,345 square meters (4,000 sy.)
	In-Place Density <sup>2/ 12/</sup>	1 sample every 1,672 square meters (2,000 sy.)
	Moisture-Density Relationship <sup>3/</sup>	1 initially and every 20 density tests.

TABLE 1 (con.)

<u>Materials</u>	<u>Test</u>	<u>Minimum Sampling and Testing Frequency</u>
<u>Portland Cement Concrete</u> (Non airfield)		
Coarse and Fine Aggregate <sup>7/</sup>	Moisture, specific gravity and absorption <sup>8/</sup>	1 initially.
	Gradation and fineness modules	1 every 191 cubic meters (250 cy) of concrete.
	Moisture, specific gravity and absorption <sup>8/</sup>	(same as coarse aggregate).
Concrete	Slump	Conduct test every day of placement and for every 19 cubic meters (25 cy) and more frequently if batching appears inconsistent. Conduct with strength tests.
	Entrained Air	Conduct with slump test.
	Ambient and concrete temperatures	Conduct with slump tests.
	Unit weight, yield, and water cement ratio	Conduct with strength tests. Check unit weight and adjust aggregate weights to insure proper yield.

TABLE 1 (con.)

<u>Materials</u>	<u>Test</u>	<u>Minimum Sampling and Testing Frequency</u>
	Flexural strength and evaluation	When specified for slabs on grade or for concrete pavements, take one set of 6 beams every 76 cubic meters (100 cy) of concrete with a minimum of 1 set per day. Two beams shall be tested at 7 days, two at 28 days, and two at 90 days.
	Compressive strength	One set of 3 cylinders per day and every 76 cubic meters (100 cy) for each class of structural concrete. Test one cylinder at 7 days and two at 28 days. Additional field cure cylinders shall be made when in situ strengths are required to be known.
Vibrators	Frequency and amplitude	Check frequency and amplitude initially and any time vibration is questionable.
	Masonry	
Concrete Masonry Units <sup>9/</sup>	Dry shrinkage <sup>10/</sup>	1 set of 3 per 10,000 units and manufacturers certification and test report.
	Air dry condition <sup>11/</sup>	Same as dry shrinkage.
	Absorption	" " " "
	Compressive strength	" " " "
	Unit Weight	" " " "
Mortar and grout	Compressive Strength	1 set of 3, every 2,000 units (1 test at 7 days and 2 tests at 28 days).

NOTES:

- 1/All acceptance tests shall be conducted from in-place samples.
- 2/Additional tests shall be conducted when variations occur due to the contractors operations, weather conditions, site conditions, etc.
- 3/Classification (ASTM D-2487), moisture contents, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable.
- 4/Materials to be submitted only upon request by the Contracting Officer.
- 5/Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.
- 6/Increase quantities by 50 percent for Paving mixes and by 100 percent for Government testing of admixtures. Include standard deviation for similar mixes from the intended batch plant and data from a minimum of 30 tests, if available. Refer to ACI 214.
- 7/A petrographic report for aggregate is required with the sample for source approval. If the total amount of all types of concrete is less than 153 cubic meters (200 c.y.) service records from three separate structures in similar environments which used the aggregates may substitute for the petrographic report.
- 8/Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for w/c calculations.
- 9/For less than 1,000 units, the above test may be waived at the discretion of the Contracting Officer and acceptance based on manufacturers certification and test report.
- 10/Additional tests shall be performed when changes are made either in the manufacturing processes or in materials used in the production of the masonry units.
- 11/If adequate storage protection is not provided at the jobsite, additional tests shall be made to determine that the allowable moisture condition has not been exceeded before the blocks can be placed in the structure.
- 12/The nuclear densometer, if properly calibrated, may be used but only in addition to the required testing frequency and procedures using sandcones. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.

TABLE 2

STANDARD REPORT FORMS AND USE

<u>Form Number</u>	<u>Form Title</u>	<u>Form Use</u>
NPD 300	Transmittal of Material Samples	Form to accompany any samples sent to NPD Laboratory
NPD 326	Compaction Test Data Sheet	Soil compaction tests.
DD 1206	Sieve Analysis Data	Sieve analysis data sheet for soils.
NPD 320	Mechanical Analysis Test Data	Sieve analysis data sheet and hydrometer data sheet for soils.
ENG 2087	Gradation Curves	Gradation graph for soils and aggregates. (To include specification limits).
DD 1205	Soil Moisture Content	Moisture content sheet for soils and/or aggregates.
NPD 322	Specific Gravity and Absorption Test Data Sheet	Specific gravity and absorption test for soil and aggregates.
DD 1209	Atterberg Limits Determinations	Test and graph for Atterburg limits tests.
DD 1217	Bituminous Mix Design -Aggregate Blending	Aggregate blending sheet for asphaltic concrete.
NPD 346	Asphaltic Concrete Mix Design Report	Asphaltic mix design and aggregate grinding.
DD 1218	Marshall Method - Computation of Properties of Asphalt Mixtures	Marshall Test form.
NPD 88	Screen Analysis of Concrete Aggregates	Gradation test form for aggregates (self carboning).
NPD 357	Mortar Strength of Fine Aggregate Data Sheet	Flexural and compressive strength test form for mortar.
NPD 355	Data Sheet - Compressive and Flexural Strengths of Concrete	Compressive and/or flexural strength testing (include averages per specification).
NPD 359	Report of Concrete Mixture Design	Mix design sheet for Contractor mix submittal.
NPS 57	Statistical Evaluation of Concrete Compression Tests	Summary sheet of concrete tests. Form can be used for flexural strengths if revised to conform with proper days specified. A separate sheet is to be used for each mix design.

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3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):

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4. QUALITY CONTROL TESTING AND RESULTS (comment on tests and attach test reports):

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5. DAILY SAFETY INSPECTIONS (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):

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6. REMARKS (Include conversations with or instructions from the Government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):

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CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

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CONTRACTOR QC REPRESENTATIVE

(Sample of Typical Contractor's Test Report)

TEST REPORT

STRUCTURE OR BUILDING \_\_\_\_\_

CONTRACT NO. \_\_\_\_\_

DESCRIPTION OF ITEM, SYSTEM, OR PART OF SYSTEM TESTED:

\_\_\_\_\_  
\_\_\_\_\_

DESCRIPTION OF TEST: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

NAME AND TITLE OF PERSON IN CHARGE OF PERFORMING TESTS FOR THE  
CONTRACTOR:

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

I HEREBY CERTIFY THAT THE ABOVE DESCRIBED ITEM, SYSTEM, OR PART OF SYSTEM  
HAS BEEN TESTED AS INDICATED ABOVE AND FOUND TO BE ENTIRELY SATISFACTORY  
AS REQUIRED IN THE CONTRACT SPECIFICATIONS.

SIGNATURE OF CONTRACTOR  
QUALITY CONTROL INSPECTOR \_\_\_\_\_

DATE \_\_\_\_\_

REMARKS

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

END OF SECTION



## SECTION 01501

### CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

#### PART 1 GENERAL

##### 1.1 AVAILABILITY OF UTILITY SERVICES

###### 1.1.1 Water and Electricity

The Contractor shall be responsible for providing his own water and electricity.

###### 1.1.1 Water

The Government will make available to Contractor, from existing outlets and supplies, reasonable amounts of potable water without charge. Contractor shall reasonably conserve potable water furnished.

Contractor, at its own expense, shall install and maintain necessary temporary connections and distribution lines and shall remove the connections and lines prior to final acceptance of construction.

###### 1.1.2 Electricity

Electric power (240 volts, 100 amps) will be made available by the Government, without charge, to the Contractor for performing work at the work area. The Contractor shall carefully conserve electricity furnished. The Contractor, at its own expense and in a workmanlike manner satisfactory to the Contracting Officer, shall extend the existing electrical distribution system (overhead and underground) for temporary electrical service to the worksite, shall install and maintain necessary temporary connections, and shall remove the same prior to final acceptance of the construction.

##### 1.2 SANITARY PROVISIONS

Contractor shall provide sanitary accommodations for the use of employees as may be necessary and shall maintain accommodations approved by the Contracting Officer and shall comply with the requirements and regulations of the State Health Department, County Sanitarian, or other authorities having jurisdiction.

##### 1.3 TEMPORARY ELECTRIC WIRING

###### 1.3.1 Temporary Power and Lighting

The Contractor shall provide construction power facilities in accordance with the safety requirements of the National Electric Code NFPA No. 70 and the SAFETY AND HEALTH REQUIREMENTS MANUAL EM 385-1-1, 03 Sept 1996. The Contractor, or its delegated subcontractor, shall enforce the safety requirements of electrical extensions for the work of subcontractors. Work shall be accomplished by journeyman electricians.

###### 1.3.2 Construction Equipment

In addition to the requirements of SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, temporary wiring conductors installed for operation of construction tools and equipment shall be either Type TW or THW contained in metal raceways, or shall be hard usage or extra hard usage multiconductor cord. Temporary wiring shall be secured above the ground or floor in a workmanlike manner and shall not present an obstacle to persons or equipment. Open wiring may only be used outside of buildings, and then only in accordance with the provisions of the National Electric Code.

### 1.3.3 Submittals

Submit detailed drawings of temporary power connections. Drawings shall include, but not be limited to, main disconnect, grounding, service drops, service entrance conductors, feeders, GFCIS, and all site trailer connections.

## 1.4 FIRE PROTECTION

During the construction period, the Contractor shall provide fire extinguishers in accordance with the safety requirements of the SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1. The Contractor shall remove the fire extinguishers at the completion of construction.

## 1.5 STAGING AREA

Contractor will be provided adequate open staging area as directed by the Contracting Officer. Area is unsecured, and Contractor shall make provisions for its own security.

Contractor shall be responsible for keeping staging area, and office area clean and free of weeds and uncontrolled vegetation growth. Weeds shall be removed by pulling or cutting to within 1-inch of ground level. Lawn areas shall be mown to keep growth to less than 2-inches. All loose debris and material subject to being moved by prevailing winds in the area shall be picked up or secured at all times.

If the area is not maintained in a safe and clean condition as defined above the Contracting Officer may have the area cleaned by others with the costs being deducted from the Contractor's payment.

## 1.6 HOUSEKEEPING AND CLEANUP

Pursuant to the requirements of Clause CLEANING UP and Clause ACCIDENT PREVENTION, of the CONTRACT CLAUSES, the Contractor shall assign sufficient personnel to insure compliance. The Contractor shall submit a detailed written plan for implementation of this requirement. The plan will be presented as part of the preconstruction safety plan and will provide for keeping the total construction site, structures, and accessways free of debris and obstructions at all times. Work will not be allowed in those areas that, in the opinion of the Contracting Officer, have unsatisfactory cleanup and housekeeping at the end of the preceding day's normal work shift. At least once each day all areas shall be checked by the Quality Control person of the Contractor and the findings recorded on the Quality Control Daily Report. In addition, the Quality Control person shall take immediate action to insure compliance with this requirement. Housekeeping and cleanup shall be assigned by the Contractor to specific personnel. The name(s) of the personnel shall be available at the project site.

## 1.7 DIGGING PERMIT

Before performing any onsite excavation, the Contractor shall notify the installation facility manager and the appropriate local authorities as required to obtain a digging permit and clearances from all the various utilities. Copies of clearances shall be provided to the Government Representative. Utility lines shall be marked in the field prior to excavation. The locations of any utilities obtained from the clearances shall be verified on or added to the as-built drawings.

## 1.8 CONSTRUCTION NEAR COMMUNICATIONS CABLES

### 1.8.1 Excavation Near Communication Cables

Digging within .9144 meters (3 feet) of communication cables (including fiber optic cables) shall be performed by hand digging until the cable is exposed. The Contracting Officer shall be notified a minimum 3 days prior to digging within a .9144 meter (3-foot) area near cable. The cable route will be marked by the Government prior to excavation in the area. A digging permit shall be obtained by the Contractor before performing any excavation. The Contractor shall be held responsible for any damage to the cable by excavation procedures. Once the cable is exposed, mechanical excavation may be used if there is no chance of damage occurring to the cable.

### 1.8.2 Reburial of Exposed Utilities

When existing utility lines are reburied a tape, detectable by pipe detector systems, shall be installed above the uncovered length of the utility at a depth of 305 mm (12 inches) below grade. Tape shall be a minimum .127 mm (5 mil) plastic tape with metallic tracer, minimum 76 mm (3 inches) wide, lettering on tape to show buried utility, and brightly colored.

### 1.8.3 Cable Cuts or Damage

If a communications cable is cut or damaged the Contractor shall immediately notify the Contracting Officer (CO) and begin gathering personnel and equipment necessary to repair the cut, or damage. Contractor shall begin repairs within one hour of the cut or damage, unless notified otherwise, and continue repairs without interruption until full service is restored.

## 1.9 PROJECT SIGN

Contractor shall furnish and install one project sign in accordance with conditions hereinafter specified and layout shown on drawing No. 49s-40-05-15, Sheets 1 and 2, except Corps of Engineers' castle and Army Reserve seal will be Government furnished. All letters shall be block type, upper case. Letters shall be painted as indicated using exterior-type paint. Sign shall be maintained in excellent condition throughout the life of job. Project sign shall be located as directed. Upon completion of project, sign shall be removed and shall remain the property of Contractor.

## 1.10 ELEVATED WORK AREAS

Workers in elevated work areas in excess of 2 meters (6 feet) above an adjoining surface require special safety attention. In addition to the provisions of SAFETY AND HEALTH REQUIREMENTS MANUAL, EM 385-1-1, the following safety measures are required to be submitted to the Contracting Officer's Representative. Prior to commencement of work in elevated work areas, the Contractor shall submit

drawings depicting all provisions of his positive fall protection system including, but not limited to, all details of guardrails. Positive protection for workmen engaged in the installation of structural steel and steel joist shall be provided by safety nets, tie-offs, hydraulic man lifts, scaffolds, or other required means. Decking crews must be tied-off or work over nets or platforms not over 2 meters (6 feet) below the work area. Walking on beams and/or girders and the climbing of columns is prohibited without positive protection. Perimeter guardrails shall be installed at floor, roof, or wall openings more than 2 meters (6 feet) above an adjoining surface and on roof perimeters. Rails shall be designed to protect all phases of elevated work including, but not limited to, roofing operations and installation of gutters and flashing. Rails around roofs may not be removed until all work on the roof is complete and all traffic on or across the roof ceases. Rails shall be designed by a licensed engineer to provide adequate stability under any anticipated impact loading. As a minimum, the rails shall consist of a top rail at a height of 1067 mm (42 inches), a mid-rail, and a toe board. Use of tie-offs, hydraulic man lifts, scaffolds, or other means of roof edge protection methods may be utilized on small structures such as family housing, prefabricated metal buildings, etc. If safety belts and harnesses are used, the positive fall protection plan will address fall restraint versus fall arrest. Body belts will ONLY be used for fall restraint, they will not be used for fall arrest.

#### 1.11 TRAFFIC CONTROL PLAN

The Contractor shall submit a Traffic Control Plan for moving traffic through and around the construction zone in a manner that is conducive to the safety of motorists, pedestrians, and workers. This plan shall indicate scheduling, placement, and maintenance of traffic control devices in accordance with the U.S. Department of Transportation, Federal Highway Administration publication, Manual on Uniform Traffic Control Devices. The Contractor shall obtain, in writing, from the Directorate of Public Works (PW) Traffic Engineer, through the Contracting Officer, approval of the Traffic Control Plan. The Contractor shall submit his Traffic Control Plan at least 15 working days prior to commencement of street or road work. Streets (except dead end) may be closed to traffic temporarily (except at least one access lane shall be kept open to traffic) by approved written request to the Contracting Officer at least 10 working days prior to street closure. Excavations shall not remain open for more than 1 working day without approval. The Contractor shall identify by site inspection and indicate on the plan all roads and trails used by military or civilian wheeled and tracked vehicular traffic and, by traffic control devices, prevent this traffic from entering the construction zone.

#### 1.12 UTILITIES NOT SHOWN

The Contractor can expect to encounter, within the construction limits of the entire project, utilities not shown on the drawings and not visible as to the date of this contract. If such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer verbally and then in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are removed or relocated as directed, the Contractor shall be entitled to equitable adjustment for any additional work or delay. The types of utilities the Contractor may encounter are waterlines, sewer lines (storm and sanitary), gas lines, fueling lines, steam lines, buried fuel tanks, septic tanks, other buried tanks, communication lines, and power lines. These utilities may be active or abandoned utilities.

#### 1.13 GOVERNMENT WITNESSING AND SCHEDULING OF TESTING

The Contractor shall notify the Contracting Officer, by serial letter, of dates and agenda of all performance testing of the following systems: mechanical (including fire protection and EMCS), electrical (including fire protection) medical and food service systems not later than 10 calendar days prior to start of such testing.

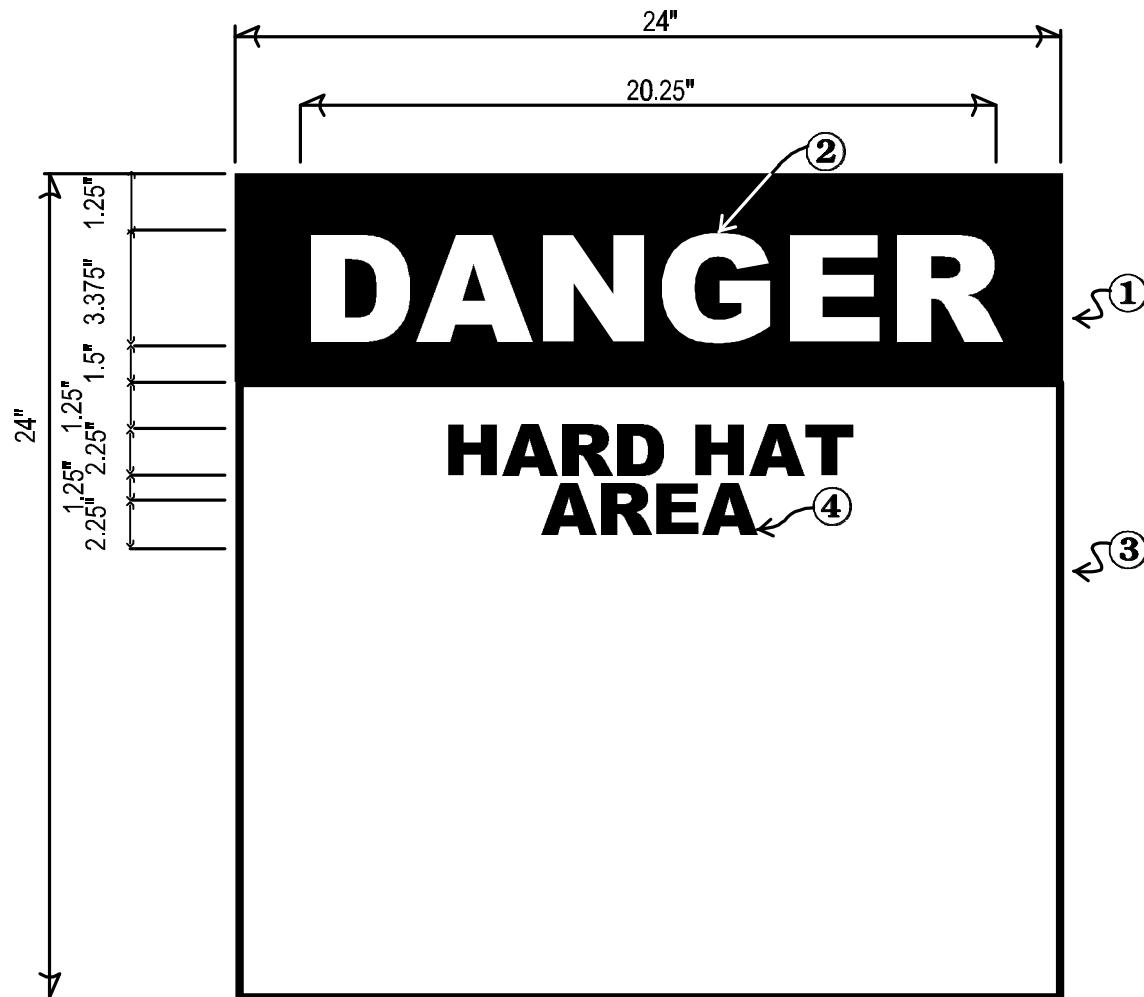
In this notification, the Contractor shall certify that all equipment, materials, and personnel necessary to conduct such testing will be available on the scheduled date and that the systems have been prechecked by him and are ready for performance and/or acceptance testing. Contractor shall also confirm that all operations and maintenance manuals have been submitted and approved. **NO PERFORMANCE AND/OR ACCEPTANCE TESTING WILL BE PERMITTED UNTIL THE OPERATIONS AND MAINTENANCE MANUALS HAVE BEEN APPROVED.**

Government personnel, at the option of the Government, will travel to the site to witness testing. If the testing must be postponed or canceled for whatever reason not the fault of the government, the Contractor shall provide the Government not less than 3 working days advance notice (notice may be faxed) of this postponement or cancellation. Should this 3 working day notice not be given, the Contractor shall reimburse the Government for any and all out of pocket expenses incurred for making arrangements to witness such testing including, but not limited to airline, rental car, meal, and lodging expenses. Should testing be conducted, but fail and have to be rescheduled for any reason not the fault of the Government, the Contractor shall similarly reimburse the Government for all expenses incurred.

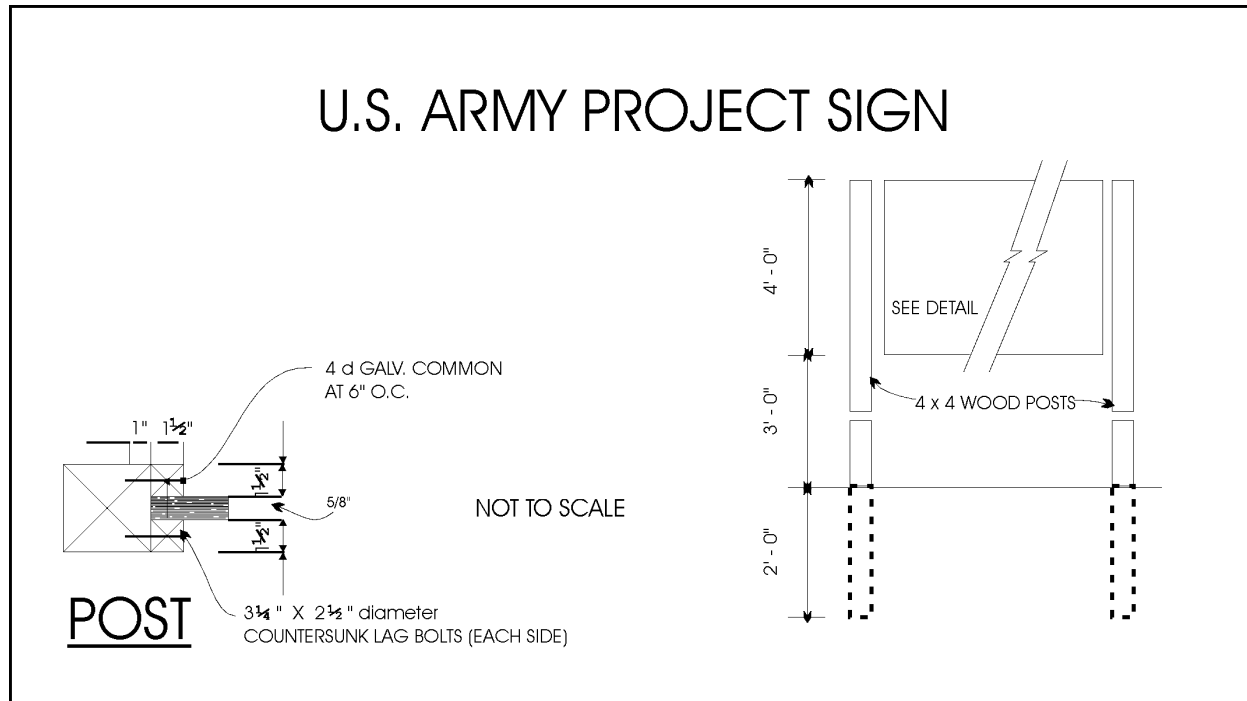
#### 1.14 HARD HAT SIGNS

The Contractor shall provide 610 mm by 610 mm (24 by 24 inch) square Hard Hat Area signs at each entry to the project or work area as directed by the Contracting Officer. A minimum of two signs will be required. Signs shall be in accordance with the sketch at the end of this section.

#### PART 2 PRODUCTS AND PART 3 EXECUTION (NOT APPLICABLE)



- SIGN SHALL BE FABRICATED FROM .125 THICK 6061-T6 ALUMINUM PANEL
- COLOR
  1. SAFETY RED (SR)
  2. WHITE
  3. WHITE
  4. BLACK
- LETTERING SHALL BE HELVETICA BOLD TYPOGRAPHY.
- LETTERS AND BACKGROUND SHALL BE REFLECTIVE SHEETING MATERIAL.
- SIGNS SHALL BE POSTED AT 6'-6" (BOTTOM SIGN TO GRADE) OR AS DIRECTED BY THE CONTRACTING OFFICER.
- LETTERING TO BE CENTERED ON PANEL.

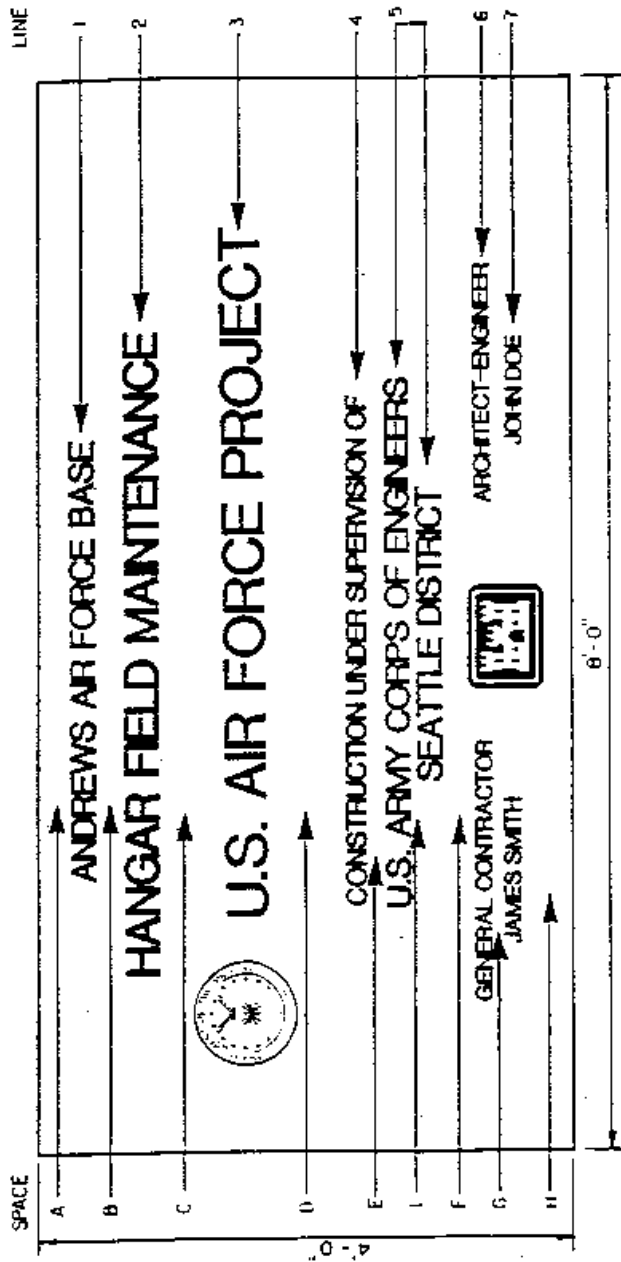


NOTES:

1. Signboard 4' x 8' x 5/8" grade A-C exterior type plywood with medium density overlay on both sides.
2. Paint both sides and edges with one prime coat and two coats of paint, color white exterior type enamel. Lettering shall be as shown on drawing and shall be black gloss exterior type enamel.
3. Lettering shall be Helvetica medium.
4. Acceptable abbreviations may be used for Contractor's name.
5. Department of Air Force Seal and Corps of Engineers' Castle to be Government furnished.
6. No company logo shall be used.
7. Sign posts and 1 1/2" wood trim shall be painted white.
8. Upon completion of work under this contract, the project sign shall be removed from the job site and shall remain the property of the Contractor.

NOTE: The Contractor shall verify the colors to be used with the Contracting Officer prior to constructing the sign.

SHEET 2 OF 2



SAMPLE CONSTRUCTION SIGN FOR MCP PROJECTS

SCHEDULE

SPACE	HT.	LINE	DESCRIPTION	LETTER	STROKE
					HT.
A	2"	1	LOCATION	2	3/8"
B	2 5/8"	2	PROJECT NOMENCLATURE *	3	1/4"
C	5 3/4"	3	U.S. AIR FORCE PROJECT	4	3/8"
D	6"	4	CONSTRUCTION UNDER SUPERVISION OF	1 1/2"	1/8"
E	4"	5	CONSTRUCTION AGENCY *	2 3/8"	1/4"
F	4"	6	GENERAL CONTRACTOR *	1 3/8"	3/16"
G	1"	7	GENERAL CONTRACTOR	1 3/8"	3/16"
H	2 7/8"	*	WILL VARY TO SUIT PROJECT REQUIREMENTS		
I	2"		SEATTLE DISTRICT		

U.S. AIR FORCE

PROJECT

CONSTRUCTION SIGN

Sheet 1 of 2  
U.S. Army Corps of Engineers, Seattle, WA.  
FRI B.L.M. Transmitted with report  
FRI B.L.M. DATED 20 JUNE 84  
GRI B.L.M. File No. 494 / 40-05-15

END OF SECTION



## SECTION 01545

### PROTECTION OF WORK AND PROPERTY

#### PART 1 GENERAL - NOT USED

#### PART 2 PRODUCTS

##### 2.1 ORANGE FENCING

Orange fencing shall be a minimum of 42 inches high and be highly visible. It shall be resistant to fading when exposed to sunlight. Fencing shall be made of high-density polyethylene or other material with similar strength characteristics. Fencing shall be corrosion resistant.

#### PART 3 EXECUTION

##### 3.1 ORANGE FENCING

The Contractor shall provide and erect orange fencing prior to beginning construction to clearly indicate construction boundaries as shown on the drawings. Contractor shall maintain fencing throughout construction and remove and dispose of fencing at the completion of construction.

END OF SECTION

99020/AN  
FORT LAWTON PHASE TWO

083001

## SECTION 01701

### OPERATIONS AND MAINTENANCE MANUALS

#### PART 1 GENERAL

##### 1.1 SUBMITTALS

Submittals shall be in accordance with Section SUBMITTAL PROCEDURES .

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 GENERAL

The Contractor shall provide Operation and Maintenance (O&M) manuals for the complete project as applicable under this contract, including all Contractor furnished and installed equipment, systems and materials, and all Government furnished-Contractor installed equipment, systems and materials. Included herein are requirements for compiling and submitting the O&M data. Additional O&M data requirements are specified in the individual sections of the technical specifications. O & M Manual requirements shall be coordinated with the requirements as stated in the other technical specification sections and shall include listings for spare parts, framed instructions, etc.

##### 3.1.1 PREPARATION

Manual preparation shall be under the direction of an individual or organization that has demonstrated expertise and a minimum of 3 years experience in the preparation of comprehensive and complete O&M manuals. Qualifications shall be submitted for Contracting Officer approval.

##### 3.1.2 FORMAT

3.1.2 O&M data shall be separated into distinct systems. O&M manuals for any particular system shall include narrative and technical descriptions of the interrelations with other systems. This narrative shall include a description on how the system works with notable features of the system, including normal and abnormal operating conditions. The explanation of the system is to be short and concise with reference to specific manufacturer's equipment manuals for details (see paragraph CONTENT, subparagraph b). If the quantity of material is such that it will not fit within one binder then it shall be divided into volumes, as required (see paragraph Binders).

3.1.3 Six copies of the complete set of manuals shall be provided for each building (as identified by a building number or building description) for multi-building projects. For those multi-building projects where the work is identical in each building, one copy of the manual is required for each building plus six additional copies. For those projects that do not have work in specific buildings, six copies of the manuals

are required for the complete project. Any project may have a combination of these requirements to determine the total number of copies required.

3.1.4 The requirement for six copies of the O&M manual shall supersede and replace any requirements for a lesser amount of manuals which may be indicated in some specifications. Each set of manuals shall be tailored for its respective building or facility.

### 3.2 PRELIMINARY O&M MANUAL AND DATA SUBMITTAL

To establish and assure uniform O&M manual format, the Contractor shall submit two copies of complete set of O & M data without the binders and receive Contracting Officer approval on one (1) of the sets prior to submission of the final bound manuals. Initial O&M Manual data submittal shall be a minimum of 30 days prior to 90 percent project completion.

The Contractor shall also provide two typewritten pages representing the proposed binder marking format as required under Paragraph: Marking and Binding. One page will represent the front cover/spine and the other page will represent the inside of the front cover.

3.2.1 Data submitted for the manual are to be for the specific equipment furnished, and are in addition to that furnished as shop drawings.

3.2.2 The Contracting Officer will require thirty (30) days for review of submitted O&M manual(s) or data. The Contracting Officer will retain one copy of unacceptable O&M manual submittal and return remainder of copies to the Contractor marked "Returned for Correction." If "Returned for Correction." the Contractor shall resubmit the required number of copies of the manual(s) incorporating all comments, prior to substantial completion and/or use and possession. The Contractor may, at his option, update the copy retained by the Government in lieu of providing the added copy.

3.2.3 For equipment or systems requiring personnel training and/or acceptance testing, the final O&M data shall be approved by the Contracting Officer prior to the scheduling of the training and/or testing. O&M data on equipment or systems not requiring training or testing shall be submitted so all data will be approved and bound in the O&M manuals in the required quantity by the time the project reaches 90 percent completion. Failure to furnish approved, bound manuals in the required quantity by the time the project is 90 percent complete, will be cause for the Contracting Officer to hold or adjust the retained percentage in accordance with CONTRACT CLAUSE, PAYMENTS UNDER FIXED PRICE CONSTRUCTION CONTRACTS.

3.2.4 Three of the six completed copies of the final O&M manuals (for each building) shall contain original manufacturer's data. Data in the remaining manuals may be duplicated copies of original data. All data furnished must be of such quality to reproduce clear, legible copies.

### 3.3 BINDERS

#### 3.3.1 Construction and Assembly

Manuals shall be sliding posts or screw-type aluminum binding posts (three screws) with spine, but only one type shall be used for all manuals. The manuals shall be hardback plastic-covered, cleanable, not over 76 mm (3 inches) thick and designed for 216 mm by 279 mm (8-1/2 by 11 inch) paper. The hard cover

shall be of minimum stiffness equal to 2.03 mm (0.080 inch) display board or double weight illustration board.

### 3.3.2 Marking and Binding

As appropriate, systems shall be grouped into four separate categories and bound into four volumes as follows: Mechanical, Electrical, Fire Protection/Security, and Architectural/General.

Each binder shall have the following information, as a minimum, inscribed on both the spine and cover using an offset or silk screen printing process; "EQUIPMENT OPERATION, MAINTENANCE, AND REPAIR MANUAL;" BUILDING NAME, IDENTIFICATION NUMBER (Building No.), LOCATION, AND DISCIPLINE (MECHANICAL, ELECTRICAL, FIRE PROTECTION/SECURITY, ARCHITECTURAL/GENERAL). Contractor's name and address as well as the contract title and contract number shall be printed on the inside of the front cover.

### 3.3.3 Color

Color of binder and printing shall be the option of the Contractor except that; (a) printing color shall contrast with binder color, and (b) colors shall be the same for all manuals.

### 3.3.4 Content

The O&M manuals shall be structured to address each of the following topics in order for each system. When the topic does not apply to a particular system the topic name will be included in the manual with the words "DOES NOT APPLY."

a. Warning Page: A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

b. Index: Each manual shall have a master index at the front identifying all manuals and volumes and subject matter by system name for each. Following the master index, each manual shall have an index of its enclosures listing each volume, tab numbers, etc., as necessary to readily refer to a particular operating or maintenance instruction. Rigid tabbed fly leaf sheets shall be provided for each separate product and/or piece of equipment under each system in the manual. For example, if a system includes Air Handling Units 1 through 5, there shall be tab sheets AHU-1, AHU-2, AHU-3, AHU-4 and AHU-5. When a manual is divided into volumes, each volume shall have a master index at its front, followed by an index for the specific volume listing in detail all enclosed instructions for materials, individual pieces of equipment, and systems. All pages shall be numbered with the referenced number included in the index.

c. Description: Narrative and technical descriptions of the system and of the interrelations with other systems.

d. Check List Prior to Start Up: Precautions and prechecks prior to start up of equipment and/or system, including safety devices, monitoring devices and control sequence shall be provided.

e. Start Up and Operation: Step-by-step sequential procedures for start up and normal operation checks for satisfactory operation shall be provided. Safety precautions and instructions that should be followed

during these procedures shall be incorporated into the operating instructions and flagged for the attention of the operator. Procedures shall include test, manual or normal, and automatic modes.

f. Shutdown: Procedures for normal and emergency shutdown of equipment and/or systems shall be provided. The instructions shall include any procedures necessary for placing the equipment and/or system on standby or preparing the equipment and/or system for start up at a later time. Procedures shall include test, manual or normal, and automatic modes.

g. Operator Preventive Maintenance, Major Maintenance, and Adjustments: The instructions shall include recommended operator preventive maintenance which would normally be performed by operating personnel and adjustment procedures necessary for normal operation. Schedules shall be provided indicating time frames or operating hours for initiating operator maintenance and adjustments, and including manufacturer's recommended major maintenance requirements. Emergency adjustments shall be included and flagged for operator's attention; the instructions shall also include procedures for emergency repairs that could be performed by operating personnel. These emergency repairs or "trouble-shooting guides" shall be outlined in three columns with the following headings:

Column 1 - Trouble  
Column 2 - Probable Cause(s)  
Column 3 - Correction

h. Operator Data: The instructions shall include equipment and/or system layouts showing all piping, wiring, breakers, valves, dampers, controls, etc., complete with diagrams, schematics, isometrics, and data to explain the detailed operation and control of each individual piece of equipment and/or system, including system components. Layouts shall show the location within the facility of controls, valves, switches, dampers, etc., by reference to site location, wing designation, floor, room number, or other clear and concise directions for locating the item. Operator data may be identical to posted data and framed instructions but shall be prepared as part of the O&M manuals. All control systems operations data shall include the following:

(1) A fully labeled control schematic which details all set points, throttling ranges, actions, spans, proportional bands, and any other adjustment.

(2) A fully labeled elementary diagram (ladder diagram).

(3) A sequence of control on the diagrams cross-referenced to the control schematic and elementary diagram.

(4) A generic, functional description of each control component shown on the drawings.

(5) Catalog data of every control device.

i. Electrical Layout Drawings: The Electrical O&M's shall include complete layout drawings and one-line diagrams of exterior and interior electrical with reference to the buildings and site layout. Drawings shall include layout of interior lighting, interior power, intrusion detection systems, communication systems and fire protection systems. Exterior layout drawings shall show where fed from, pad-mount transformer, metering, main distribution panel and communication lines. Layout drawings shall show the location within the facility or reference to the building and the site plan. Layout drawings shall be half size contract

as-built drawings and shall be inserted into plastic pockets and installed at the back of the O&M's that pertain to that particular drawing.

j. Maintenance Procedures: Recommended procedures shall indicate preventive maintenance, lubrication, and good housekeeping practices which should be performed by operating personnel as well as more complex maintenance procedures which would normally be performed by trained maintenance personnel only. The procedures shall be presented with a schedule indicating time frames or operating hours for specific maintenance to be accomplished. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the maintenance procedures and flagged for the attention of personnel. The procedures shall include necessary operating instructions for taking equipment off line, putting equipment on line, or putting equipment on standby. The instructions shall include all necessary material, equipment, and system data to perform maintenance work and shall include, but not be limited to, manufacturers/bulletins, catalogs, and descriptive data; certified performance curves, copies of approved test plans, including logs and records of performance acceptance test results, and actual adjustments made during final acceptance and inspection; system layouts, including block diagrams, wiring, control, and isometric diagrams; schematic items within the facility; and interrelationships with other items of system.

k. Repairs: Repair procedures shall be presented with a step-by-step procedure for locating and correcting the trouble. A "shop manual" may be used for this purpose. Repair procedures shall be keyed to a troubleshooting guide outlined in three columns with the following headings:

Column 1 - Trouble  
Column 2 - Probable Cause(s)  
Column 3 - Correction

The procedures shall clearly indicate a major repair activity which should only be performed in a shop or factory versus normal repair work that may be performed onsite or with equipment online. The procedures shall also clearly indicate the limit of repair work that may be performed by Government personnel during the warranty period without voiding warranty provisions. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the repair procedures and flagged for the attention of personnel.

l. Tools: The Contractor shall provide one of each nonstandard tool, test instrument, and gauge necessary for performing maintenance and repair work. A nonstandard tool, test instrument, or gauge is defined as an item normally supplied by the manufacturer for the equipment operation or maintenance. The Contractor shall prepare a master list of such items for all equipment and systems and shall key maintenance and repair procedures to this list. The above referenced items for performing maintenance and repair work shall be provided for each individual facility of multifacility projects.

m. Parts and Supplies: A complete list of parts and supplies shall be provided with the maintenance instructions. The list shall include all parts and components of individual pieces of equipment, and all parts and components of each system and shall identify such items as description of part, model number, circuit or component identification, etc. Parts and supplies lists shall be included within each volume of maintenance instructions. Further, a master list of spare parts and supplies recommended from each manufacturer for 1 year of operation, including source of supply, shall be sublisted with each instruction.

(1) Availability: The Contractor shall list the sources of supply for all parts and supplies, including name of supplier/manufacturer, address, and telephone number. If the parts and supplies are not

normally stocked locally, (within 6 hours travel time, round trip by surface transportation) necessary procurement time shall also be a part of the listing.

(2) Spare Parts: The Contractor shall provide those spare parts and supplies that are specified in the TECHNICAL SPECIFICATIONS and those which are normally provided with the equipment or material item. A separate master list shall be provided for these items upon turnover to the Government of the parts and supplies.

n. Maintenance Schedule: A separate schedule of all required periodic maintenance shall be included. This schedule shall list by frequency of occurrence all lubricants and special adjustments required. The types and amounts of lubrication must be specified. The Contractor shall verify that the furnished maintenance schedule agrees with the published manufacturer's data.

#### 3.3.4.1 Architectural/General O&M:

(1) Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products. Data shall include, but not be limited to, information on carpet, floor tile, vinyl wall finishes, builder's hardware, etc.

(2) Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

(3) Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

(4) Additional Requirements: As specified in individual specifications sections.

#### 3.3.4.2 Warranties:

In addition to the general warranty required by the contract, the O&M manuals shall include any specific warranties required by other sections of the TECHNICAL SPECIFICATIONS and other warranties normally provided with the particular piece of equipment or system. Extended warranties normally provided by manufacturers that are beyond the warranty of construction shall be specifically noted. The O&M manuals shall also include a specific warranty section itemizing all standard and extended warranty items. The warranty list shall be as indicated below. Warranties will not begin until the facility is accepted by the Contracting Officer. Copy of warranty shall be included in the manual.



## WARRANTY INFORMATION

Project Title  
Contract Number

General Contractors Name, Phone Number

<u>ITEM DESCRIPTION</u>	<u>START DATE</u>	<u>END DATE</u>	<u>O &amp; M REFERENCE LOCATION</u>
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(in alphabetical  
order)

Descriptive Name,  
Manufactures/  
Warrantors Name  
Address & Phone No.

### 3.3.4.3 Installed Equipment Lists:

A copy of the completed Equipment in Place forms required in Section EQUIPMENT-IN-PLACE -LIST shall be included in the manual. The completed forms shall be located at the front of the catalog and O&M data for the equipment listed on the form.

### 3.3.4.4 Data Layout:

(1) Data Identification: Catalog data shall be marked to clearly identify pertinent data by highlighting the data with pointers or crossing out all nonpertinent data.

(2) Drawings: All drawings bound in the manuals shall be of such size that will require only one fold made right to left. All larger size drawings shall be inserted into a separate pocket in the required location in the manual. All drawings shall be of microfilm quality.

(3) Posted Data: The Contractor shall provide posted data for equipment or systems, in addition to O&M manuals, and as required by other Technical Specifications sections. The data shall consist of as-built schematics of all wiring, controls, piping, etc., as necessary for the operation of the equipment or system, and a condensed typewritten description of the system. The posted data may include approved shop drawings, layout drawings, riser, and block diagrams and shall indicate all necessary interrelation with other equipment and systems. The data may be presented in one or several frames, under glass or sheet acrylic glazing, for clarity and convenience of location. The framed data presentation and outline shall be acceptable to and posted at locations designated by the Contracting Officer. The data shall be posted before personnel training or performance testing acceptance for the related items of equipment or system.

(4) Framed Instructions: Typewritten instructions, framed under glass or sheet acrylic glazing, explaining equipment or system prestart checkout, startup, operations and shutdown procedures, safety precautions, preventive maintenance procedures, and normal operation checks for satisfactory performance of the equipment of systems shall be posted in conjunction with the posted data. The framed instructions may be presented in one or several frames for clarity and convenience of location. The instruction

presentation and outline shall be acceptable to the Contracting Officer prior to posting, and shall be posted at locations designated by the Contracting Officer. All framed instructions shall be posted before personnel training or performance testing acceptance commences for the related item of equipment or system.

### 3.3.5 Payment

No separate payment will be made for the preparation and submittal of O&M manuals. All costs incurred by the Contractor in the preparation and submittal of O&M manuals shall be considered as part of the price for the equipment and included in the contract price. Approval and acceptance of the final O&M manuals shall be accomplished before final payment is made to the Contractor.

### 3.3.6 Checklist

Contractor shall complete and initial a copy of the O&M Manual Check List which is provided at the end of this section, and forwarded along with ENG form 4025 as part of the O&M Manual submittal to the Contracting Officer for approval.

#### O&M MANUAL - REVIEW CHECKLIST

\_\_\_ Does the manual cover all equipment furnished under the contract? (Review against equipment schedules on the drawings and/or equipment submittals.)

\_\_\_ Does the manual clearly highlight all relevant portions or cross out all irrelevant portions of catalog data?

\_\_\_ Does the manual contain operations data for the equipment? (Step-by-step operating instructions, start up procedures, sequences of operation, precautions.)

\_\_\_ Does the manual contain maintenance and repair data for the equipment? (Lubrication, dismantling, assembly, adjustment, troubleshooting.)

\_\_\_ Does the manual contain a separate maintenance schedule listed by frequency of occurrence?

\_\_\_ Does the manual contain parts lists or parts catalogs for the equipment? Parts catalog or list shall contain identification, part numbers, recommended parts to be stocked, and local source of parts.

Does the manual contain electrical connection diagrams?

\_\_\_ Does the manual contain control and interlock system diagrams where applicable?

Is every page in the manual numbered and an index provided for ready reference to the data?

Is the cover hard (nonflexible) with the facility name, identification number, location, and system embossed on both the spine and cover? Is the Contractor's name and address, and the contract title and contract number embossed on the inside of the manual cover?

Is the binding screw posts or sliding post?

\_\_\_ Is any of the data in the manual under the binding where it cannot be seen?

\_\_\_ Do three sets of manuals contain all original data sheets and are others clearly legible?

Are system layout drawings provided? (Simplified diagrams for the system as installed.)

\_\_\_ Are all drawings in the manual of such a size that requires one fold right to left, or if a larger size drawing, then inserted into a pocket in the manual?

Note that the above are common requirements to all contracts. Check the specific contract for additional information.

END OF SECTION



## SECTION 01702

### AS BUILT RECORDS AND DRAWINGS

#### PART 1 GENERAL

##### 1.1 SUBMITTALS

Data listed in PART 3 of this section shall be submitted in accordance with Section SUBMITTAL PROCEDURES. Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made.

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 AS-BUILT FIELD DATA

###### 3.1.1 General

The Contractor shall keep at the construction site two complete sets of full size blue-line prints of the contract drawings, reproduced at Contractor expense, one for the Contractor's use, one for the Government. During construction, both sets of prints shall be marked to show all deviations in actual construction from the contract drawings. The color red shall be used to indicate all additions and green to indicate all deletions. The drawings shall show the following information but not be limited thereto:

- a. The locations and description of any utility lines and other installations of any kind or description known to exist within the construction area. The location includes dimensions and/or survey coordinates to permanent features.
- b. The locations and dimension of any changes within the building or structure, and the accurate location and dimension of all underground utilities and facilities.
- c. Correct grade or alignment of roads, structures, and utilities if any changes were made from contract plans.
- d. Correct elevations if changes were made in site grading from the contract plans.
- e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including, but not limited to, fabrication erection, installation, and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

- f. The topography and grades of all drainage installed or affected as part of the project construction.
- g. All changes or modifications from the original design and from the final inspection.
- h. Where contract drawings or specifications allow options, only the option actually used in the construction shall be shown on the as-built drawings. The option not used shall be deleted.

These deviations shall be shown in the same general detail utilized in the contract drawings. Marking of the prints shall be pursued continuously during construction to keep them up to date. In addition, the Contractor shall maintain full size marked-up drawings, survey notes, sketches, nameplate data, pricing information, description, and serial numbers of all installed equipment. This information shall be maintained in a current condition at all times until the completion of the work. The resulting field-marked prints and data shall be referred to and marked as "As-Built Field Data," and shall be used for no other purpose. They shall be made available for inspection by the Contracting Officer's representative whenever requested during construction and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. Failure to keep the As-Built Field Data (including Equipment-in-Place lists) current shall be sufficient justification to withhold a retained percentage from the monthly pay estimate.

### 3.1.2 Submittal of the As-Built Field Data

Two sets of the As-Built Field Data shall be submitted to the Contracting Officer for review and approval a minimum of 20 calendar days prior to the date of final inspection. If review of the preliminary as-built drawings reveals errors and/or omissions, the drawings will be returned to the Contractor for corrections. The Contractor shall make all corrections and return the drawings for backcheck to the Contracting Officer within 10 calendar days of receipt. When submitted drawings are accepted, one set of marked drawings will be returned to the Contractor for the completion of the as-built drawings.

## 3.2 AS-BUILT ELECTRONIC FILE DRAWINGS

3.2.1 No earlier than 30 days after award the Government will have available for the Contractor one set of Intergraph MicroStation® electronic file format contract drawings, to be used for preparation of as-built drawings. The electronic file drawings will be available on either 89 mm (3-1/2 inch) 1.44 MB floppy disks or ISO-9660 CD-ROM, as directed by the Contracting Officer. The Contractor has 30 days after the receipt of the electronic file to verify the usability of the MicroStation® files and bring any discrepancies to the attention of the Contracting Officer. Any discrepancies will be corrected within 15 days and files returned to the Contractor. The Contractor shall incorporate all deviations from the original contract drawings as recorded in the approved 'As-built Field Data' (see paragraph 3.1.2). The Contractor shall also incorporate all the written modifications to the contract drawings which were issued by amendment or contract modification. All revisions and changes shall be incorporated, i.e. items marked "deleted" shall be deleted, clouds around new items shall be removed, etc.

3.2.2 No later than 30 days after final acceptance a complete set of as-built drawings shall be submitted in Intergraph MicroStation® electronic file format. The electronic file format, layering standards and submittal requirements are specified in paragraphs below. The as-built drawings shall be done in a quality equal to that of the originals. Line work, line weights, lettering, and use of symbols shall be the same as the original line work, line weights, and lettering, and symbols. If additional drawings are required they shall be prepared in electronic file format under the same guidance. When final revisions have been completed, each drawings shall be identified with the words "AS-BUILT" in block letters at least 3/8-inch high placed

above the title block if space permits, or if not, below the title block between the border and the trim line. The date of completion and the words "REVISED AS-BUILT" shall be placed in the revision block above the latest revision notation.

### 3.2.3 Electronic File Submittal Requirements

3.2.3.1 The MicroStation® electronic file(s) deliverable shall be in MicroStation® version 5.0 'DGN' binary format. All support files required to display or plot the file(s) in the same manner as they were developed shall be delivered along with the files. These files include but are not limited to Font Libraries, Pen Tables, and Referenced files.

3.2.3.2 Layering shall conform to the guidelines defined by the American Institute of Architects (AIA) standard document, "CAD Layer Guidelines", Copyright 1990. An explanatory list of which layer is used at which drawing and an explanatory list of all layers which do not conform to the standard AIA CAD Layer Guidelines, including any user definable fields permitted by the guidelines, shall be provided with each submittal.

3.2.3.3 Electronic File Deliverable Media: All electronic files shall be submitted on MS-DOS® FAT or extended FAT format 89 mm (3½ inch) 1.44 MB floppy disks or ISO 9660 format CD-ROM, as directed by the Contracting Officer. Two complete sets of disks shall be submitted along with one complete set of prints [and one complete set of mylars] taken from the disks. Each floppy disk shall be clearly marked with typewritten self-adhesive disk labels which shall contain the following information: Contractor's firm name, project name and location, submittal type (AS-BUILT), the name of each file contained within the disk or archive file, the format and version/release number of each file, a disk number indicating the numeric sequence of the disk in the submittal along with the total number of disks in the submittal, and date the disk was made. If submittal is made on CD-ROM, only the Contractor's firm name, project name and location, submittal type (AS-BUILT) and date will be required. Each submittal shall be accompanied by a hard copy transmittal sheet that contains the above information along with a tabulated information about each file, as shown below:

<u>Electronic File Name</u>	<u>Plate Number</u>	<u>Drawing Title</u>
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Electronic version of the table shall be included with each submittal set of disks.

### 3.2.4 Submittal of the Final As-Built Drawings

The final as-built record drawings shall be completed and returned together with the approved preliminary as-built drawings to the COE, Seattle District Office, Technical Branch, Records and Information Section, within 30 calendar days of final acceptance. All drawings from the original contract drawings set shall be included, including the drawings where no changes were made. The Government will review all final as-built record drawings for accuracy and conformance to the drafting standards and other requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The drawings will be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the drawings to the same office within 7 calendar days of receipt.

3.3 All costs incurred by the Contractor in the preparation and furnishing of as-built drawings in electronic file format shall be included in the contract price and no separate payment will be made for this work. Approval and acceptance of the final as-built record drawings shall be accomplished before final payment is made to the Contractor.

3.4 One set of marked-up as-built blue-line prints shall be furnished at the time of system acceptance testing. These as-built blue-line prints shall be in addition to the submittals of marked-up as-built blue-line prints specified elsewhere in the contract.



## SECTION 01703

### WARRANTY OF CONSTRUCTION

#### PART 1 GENERAL

##### 1.1 SUBMITTALS

Submittals shall be made in accordance with Section SUBMITTAL PROCEDURES. Submittal dates shall be as defined in PART 3 of this section.

##### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 WARRANTY OF CONSTRUCTION (APR 1984) (FAR52.246-21):

3.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 3.1.9 of this Clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

3.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

3.1.3 The Contractor shall remedy at the Contractor's expense, any failure to conform, or any defect. In addition, the Contractor shall remedy, at the Contractor's expense, any damage to Government-owned or controlled real or personal property, when that damage is the result of:

- a. the Contractor's failure to conform to contract requirements or
- b. any defect of equipment, material, workmanship, or design furnished.

3.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

3.1.5 The Government will notify the Contractor, in writing or by telephone, after the discovery of any failure, defect, or damage and the Contractor shall respond and be on-site to investigate the problem within 1 working day after notification. The Contractor shall furnish, and maintain, a 24 hour emergency telephone number as the point of contact. For failures, defects, or damage causing loss of power or heat, the Contractor shall respond and mitigate problem within 4 hours.

3.1.6 If the Contractor fails to remedy any failure, defect, or damage within 5 working days after receipt of notice, the Government will have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

3.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

- a. obtain all warranties that would be given in normal commercial practice;
- b. require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and
- c. enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

3.1.8 In the event the Contractor's warranty under paragraph 3.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

3.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

3.1.10 This warranty shall not limit the Government's rights under the Inspection of Construction clause of this contract with respect to latent defects, gross mistakes, or fraud.

3.1.11 After final acceptance of the work, the Contractor shall furnish and install an Equipment Warranty Sticker on Contractor-installed equipment. (Same equipment as listed on the Equipment-In-Place List required under Section EQUIPMENT-IN-PLACE LIST). Lettering shall be block-type upper case and easily readable. Sticker shall be of a durable type material and of a type that can be written on. Sticker shall state the following:

- a. The title "Equipment Warranty."
- b. Contractor's name and Contract Number.
- c. Date warranty expires.
- d. Point of contact, including name and telephone number.
- e. Manufacturer.

3.1.12 Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis shall not be included in this warranty. In this event, the Contractor shall require the subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

END OF SECTION

SECTION 01704  
FORM 1354 CHECKLIST

PART 1 GENERAL

1.1 Procedures

The form, which is a part of this specification section, shall be completed for any project having revisions to real property. The following page contains the basic instructions applicable to the form.

1.2 Submittal

This form shall be submitted for approval, and be approved a minimum of 30 days before final inspection of the project. Failure to have this form completed and approved in time for the final inspection will result in delay of the inspection until the checklist is completed.

PARTS 2 AND 3 NOT USED

## **INSTRUCTIONS FOR DD FORM 1354 CHECKLIST**

The following checklist is only a guide to describe various parts of new and modified construction. Alter this form as necessary or create your own document to give complete accounting of the real property added or deleted for this contract. All items added, deleted, replaced, or relocated within the building 1.5 meter (5 foot line), or on site 1.5 meters (5 feet) beyond the building perimeter must be accounted for completely. Only a few of the most common items beyond the 1.5 meter (5 foot) line are included on the checklist under UTILITIES/SURFACE CONSTRUCTION, add additional items as required by the construction accomplished.. Attach a continuation sheet and use the checklist format to describe other work related to this particular project. Listed on the last page are additional items with units of measure and descriptive terms.

Costs for each item must include material, tax, installation, overhead and profit, bond and insurance costs. This form should be filled out as each item is installed or each phase of work is completed.

TOTAL FOR ALL ITEMS INCLUDING CONTRACT MODIFICATION COSTS ADDED TOGETHER SHOULD EQUAL THE TOTAL CONTRACT PRICE.

NOTE: USE METRIC UNITS OF MEASURE INSTEAD OF ENGLISH UNITS SHOWN.

### **KEY TO ABBREVIATIONS**

AC - Acres  
BL - Barrels, Capacity  
BTU - British Thermal Unit  
CY - Cubic Yards  
EA - Each  
GA - Gallons, Capacity  
HD - Head  
KV - Kilovolt-Amperes, Capacity (KVA)  
KW - Kilowatts, Capacity  
SE - Seats  
SF - Square Feet  
SY - Square Yard  
MB - Million British Thermal Units  
MI - Miles  
LF - Linear Feet  
KG - Thousand Gallons Per Day, Capacity  
TN - Ton  
# - Number; How Many

**DD FORM 1354 CHECKLIST**

Transfer of Real Property

**CONTRACT NUMBER:** \_\_\_\_\_

**CONTRACT TITLE:** \_\_\_\_\_

**LOCATION:** \_\_\_\_\_

1. **DEMOLITION** (Describe each item removed and the cost of removal.)\*

2. **RELOCATION** (Describe each item relocated and the cost of relocation.)\*

3. **REPLACEMENTS** (Describe each item replaced and replacement cost.)\*

\*Use a continuation sheet if more space is required. Items should be described by quantity and the correct unit of measure.

4. **NEW CONSTRUCTION OVERVIEW: BUILDING(S)/ADDITION(S) TO A BUILDING** - Use a separate checklist for each building and/or addition.

(1) **Outside Dimensions: Length x Width**

- (a) Main Building\_\_\_\_\_
- (b) Offsets\_\_\_\_\_
- (c) Wings\_\_\_\_\_
- (d) Basement\_\_\_\_\_
- (e) Attic\_\_\_\_\_

(2) **Number of Usable Floors:** \_\_\_\_\_

(3) **Construction: Exterior Materials Used**

- (a) Foundation (such as concrete)\_\_\_\_\_
- (b) Floors (such as wood, concrete)\_\_\_\_\_
- (c) Walls (such as wood siding, metal, CMU)\_\_\_\_\_
- (d) Roof (such as metal, comp., built-up)\_\_\_\_\_

(4) **Utilities ENTERING Building:** Measure lineal meters (LF) from Bldg entry to next larger size of pipe

- (a) Water (size & type of pipe; number of lineal meters (LF))\_\_\_\_\_
- (b) Gas (size & type of pipe; number of lineal meters (LF))\_\_\_\_\_
- (c) Sewer (size & type of pipe; number of lineal meters (LF))\_\_\_\_\_
- (d) Electric (phase, voltage, size & type of wire, connected load  
in amps)\_\_\_\_\_

(5) **Air Conditioning:**

- (a) Type\_\_\_\_\_
- (b) Capacity Kilograms (TONS)\_\_\_\_\_
- (c) SQ METERS (SQ YDS) covered by system\_\_\_\_\_

(6) **Heating:**

- (a) Source\_\_\_\_\_
- (b) Fuel\_\_\_\_\_

(7) **Hot Water Facilities:**

- (a) Capacity Liters (GAL) \_\_\_\_\_  
(b) Temperature Rise \_\_\_\_\_

BUILDING COST: \_\_\_\_\_

**5. BUILDING SYSTEMS (INTERIOR)**

**A. FIRE PROTECTION:**

Property Code

- (1) (880 50/880-211) CLOSED HEAD AUTO SPRINKLERS - Square Meters (SF) & HD (wet or dry pipe; # of Lineal Meters (LF) of service pipe; type of pipe & # of heads; # of Square Meters (SF) covered by system)

DESCRIPTION:

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COST: \_\_\_\_\_

- (2) (880 50/880-212) OPEN HEAD DELUGE SYSTEM - Square Meters (SF) & HD (# of Lineal Meters (LF) of service pipe; type of pipe; # of heads; # of Square Meters (SF) covered)

DESCRIPTION:

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COST: \_\_\_\_\_

- (3) (880 10/880-221) AUTO FIRE DETECTION SYSTEM - Square Meters (SF) & EA (# of alarms-horns, bells, etc.; # of smoke detectors; # of heat detectors; # of fire alarm panels; # of radio transmitters/antennae)

DESCRIPTION:

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COST: \_\_\_\_\_

- (4) (880 20/880-222) MANUAL FIRE ALARM SYSTEM - EA (# of pull stations; # of alarm horns; # of fire extinguisher cabinets)

DESCRIPTION:

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COST: \_\_\_\_\_

(5) (880 60/880-231) CO2 FIRE SYSTEM (# of bottles & size of bottles in kilograms (lbs))  
DESCRIPTION:

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COST: \_\_\_\_\_

(6) (880 60/880-232) FOAM FIRE SYSTEM - EA (# of tanks - capacity in kilograms (lbs) )  
DESCRIPTION:

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COST: \_\_\_\_\_

(7) (880 60/880-233) OTHER FIRE SYSTEM - EA  
DESCRIPTION:

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COST: \_\_\_\_\_

(8) (880 60/880-234) HALON 1301 FIRE SYSTEM - EA (# of bottles & size of bottles in kilograms (lbs))  
DESCRIPTION:

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COST: \_\_\_\_\_

**B. SECURITY:**

(1) (880 40/872-841) SECURITY ALARM SYSTEM - EA (name of system installed)  
DESCRIPTION:

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COST: \_\_\_\_\_

**C. HEATING/COOLING SYSTEMS**

(1) (826 10/890-126) A/C WINDOW UNITS - kilograms (TN) & Square Meters (SF)-(# of units installed; amount of Square Meters (SF) covered per unit; size & capacity of each unit)  
DESCRIPTION:

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COST: \_\_\_\_\_



(2) (826 14/890-125) A/C PLT LESS THAN 4,536 kilograms (5 TN) - kilograms (TN) & square meters (SF)-(# of kilograms (TN); # of square meters (SF) covered)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(3) (826 13/890-121) A/C PLT 4,536 to 22,680 kilograms (5 TO 25 TN) - kilograms (TN)-(# of kilograms (TN); # of square meters (SF) covered)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(4) (826 12/826-122) A/C PLT 22,680 to 2,267,962 kilograms (25 TO 100 TN) - kilograms (TN)-(# of kilograms (TN); # of square meters (SF) covered)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(5) (826 11/826-123) A/C PLT OVER 2,267,962 kilograms (100 TN) - kilograms (TN)-(# of kilograms (TN); # of square meters (SF) covered)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(6) (821 33/821-115) HEATING PLT 220/1026 W (750/3500 MB) - W (MB)-(# of kW (MBH); type of heating system - Ex: Warm air furnace, central)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(7) (821 32/821-116) HEATING PLT OVER 1026 W (3500 MB) - W(MB)-(# of kW (MBH); type of heating system)

DESCRIPTION:

\_\_\_\_\_

COST: \_\_\_\_\_

(8) (811 60/811-147) ELEC EMERGENCY POWER GENERATOR-KW-(size of engine; rating of generator in kilowatts & voltage)

DESCRIPTION:

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COST: \_\_\_\_\_

(9) (81190 or 82320-gas) STORAGE TANK FOR HEATING or GENERATOR FUEL-Liters (GA);  
TYPE; FUEL-(Size, type of tank, kind of fuel & # of liters (gallons))

DESCRIPTION:

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COST: \_\_\_\_\_

**SITE WORK**

**6. UTILITIES/SURFACE CONSTRUCTION:**

(1) (812 41/812-223) PRIM DISTR LINE OH-Lineal Meters (LF)-(# Lineal Meters (LF) of wire; size &  
type of wire; # of poles; voltage)

DESCRIPTION:

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COST: \_\_\_\_\_

(2) (812/81360) TRANSFORMERS-KVA  
POWER POLES-Lineal Meters (LF)

(# poles; # transformers - pad or pole mounted; KVA of wire; # Lineal Meters (LF) of wire)

DESCRIPTION:

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COST: \_\_\_\_\_

(3) (812 40/812-224) SEC DISTR LINE OH-Lineal Meters (LF)-(voltage; size & type of wire;  
# transformers; KVA; # Lineal Meters (LF) of wire; # of service drops; # poles)

DESCRIPTION:

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COST: \_\_\_\_\_

(4) (812 42/812-225) PRIM DISTR LINE UG-Lineal Meters (LF)-(KVA; voltage; type of conduit &  
size(encased or direct burial); size & kind of wire inside conduit; Lineal Meters (LF) of wire & conduit)

DESCRIPTION:

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COST: \_\_\_\_\_

(5) (812 42/812-226) SEC DISTR LINE UG-Lineal Meters (LF)-(type of conduit & size; type & size of wires in conduit; Lineal Meters (LF) of conduit & wire inside conduit; voltage)

DESCRIPTION:

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COST: \_\_\_\_\_

(6) (812 30/812-926) EXTERIOR LIGHTING-EA-(streets or parking area lights) (# & type of lights; whether pole mounted or not; # Lineal Meters (LF) of connecting wire if pole mounted)

DESCRIPTION:

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COST: \_\_\_\_\_

(7) (824 10/824-464) GAS MAINS-Lineal Meters (LF) (size, type, & # of Lineal Meters (LF) of pipe)

DESCRIPTION:

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COST: \_\_\_\_\_

(8) (831 90/831-169) SEWAGE SEPTIC TANK-thousand liters (KG)-(size, kind of material, & capacity)

DESCRIPTION:

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COST: \_\_\_\_\_

(9) (832 10/832-266) SANITARY SEWER-Lineal Meters (LF)-(sizes & types of pipes - # of Lineal Meters (LF) of each; # of cleanouts; # & size of manholes)

DESCRIPTION:

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COST: \_\_\_\_\_

(10) (842 10/842-245) WATER DISTR MAINS (POTABLE)-Lineal Meters (LF)-(# Lineal Meters (LF) & size, type of pipe)

DESCRIPTION:

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COST: \_\_\_\_\_

(11) (843 11/843-315) FIRE HYDRANTS-EA-(#; size & type)

DESCRIPTION:

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COST: \_\_\_\_\_

(12) (851 90/851-143) CURBS & GUTTERS-Lineal Meters (LF)-(# Lineal Meters (LF); material; width & height)

DESCRIPTION: (Is curb extruded or standard?)\_

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COST: \_\_\_\_\_

(13) (851 90/851-145) DRIVEWAY-Square Meters (SY)-Square Meters (SY); material used; thickness)

DESCRIPTION:

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COST: \_\_\_\_\_

(14) (851 10/12/851-147) ROAD-Square Meters (SY) & Lineal Meters (LF)-Square Meters (SY); material used; thickness; Lineal Meters (LF) )

DESCRIPTION:

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COST: \_\_\_\_\_

(15) (85210/11 /852-262) VEHICLE PARKING-Square Meters (SY)-Square Meters (SY); material used; thickness; # of bollards; # of wheel stops; # of regular parking spaces; # of handicap spaces)

DESCRIPTION:

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COST: \_\_\_\_\_

(16) (852 20/852-289) SIDEWALKS-Square Meters (SY) & Lineal Meters (LF)-(# Square Meters (SF) & Lineal Meters (LF); dimensions of each section & location; thickness; material used)

DESCRIPTION:

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COST: \_\_\_\_\_

(17) (871 10/871-183) STORM DRAIN DISPOSAL-Lineal Meters (LF)-(# Lineal Meters (LF) of pipe; sizes & types of pipe; # of catch basins & manholes & sizes of each)

DESCRIPTION:

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COST: \_\_\_\_\_

(18) (872 15/872-247) FENCE, SECURITY (ARMS)-Lineal Meters (LF)-(# of Lineal Meters (LF); fence material; # & type of gate(s); # strands of barbed wire on top)

DESCRIPTION:

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COST: \_\_\_\_\_

(19) (87210/12/872-248) FENCE, INTERIOR-Lineal Meters (LF)-(# of Lineal Meters (LF); fence material; # & kind of gate(s))

DESCRIPTION:

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COST: \_\_\_\_\_

(20) (890 70/890-187) UTILITY VAULT(4 or more transformers)- Square Meters (SF) (# Square Meters (SF); dimensions of vault; # of transformers)

DESCRIPTION:

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COST: \_\_\_\_\_

(21) (135 10/135-583) TEL DUCT FACILITY-Lineal Meters (LF)-(# of Lineal Meters (LF); size & type of conduit; type of wire)

DESCRIPTION:

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COST: \_\_\_\_\_

(22) (135 10/135-586) TEL POLE FACILITY-Lineal Meters (LF)-(# Lineal Meters (LF) & type of wire; # of poles)

DESCRIPTION:

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COST: \_\_\_\_\_

7. **INSTALLED EQUIPMENT:** Furnish an Equipment-In-Place List. Any price related to equipment should already be included in this checklist.

8. **SYSTEMS NOT PREVIOUSLY LISTED:** Attach a separate sheet and use the same format to describe the system(s). Example: CATV system, intercom system, or other utilities and surface construction not described on this checklist.

9. **ASBESTOS REMOVAL:** Furnish a description by building of the number of Lineal Meters (LF) of asbestos removed, number of Lineal Meters (LF) of reinsulation, number of Square Meters (SF) of soil encapsulation, and number and size of tanks, etc., where asbestos was removed. Also, identify buildings by their numbers and use.

10. **MAINTENANCE/RENOVATIONS:** List by building number and describe all additions and deletions by quantity and the correct unit of measure. Furnish a cost per building.

**UTILITIES/SURFACE CONSTRUCTION** - Listed below are some additional items which may or may not apply to your contract. EACH item installed on site should be listed and priced separately even if not included on this checklist.

- (1) IRRIGATION SYSTEM(-Lineal Meters (LF) of pipe; size & type of pipe; number and type of heads)
- (2) UNDERGROUND/ABOVEGROUND STORAGE TANKS(-Liters (GA), type of tank; material stored)
- (3) (833-354) DUMPSTER ENCLOSURE(-Square Meters (SF) & dimensions)
- (4) (890-152) UNLOADING PAD(-Square Meters (SY); material)
- (5) SIGNAGE-(Dimensions; material)
- (6) (12580) CATHODIC PROTECTION(kilometers; Lineal Feet) (MI; LF)
- (7) (87270) LIGHTNING PROTECTION-Lineal Feet (LF)
- (8) (81290) POLE DUCT RISER(-Lineal Feet (LF, type of material)
- (9) RAMPS-Square Meters (SF), material; Cubic Meters (CY) if concrete-use code for sidewalk if concrete)
- (10) (89080/890-158) LOAD AND UNLOAD PLATFORM-Square Meters (SF)
- (11) (83240/832-255) INDUSTRIAL WASTE MAIN-Lineal Meters (LF)
- (12) WHEEL STOPS-(EA; size & material)
- (13) (81350) OUTDOOR INTEGRAL DISTR CTR-(KVA)
- (14) (45110) OUTDOOR STORAGE AREA-Square Meters (SF)
- (15) (73055/730-275) BUS/WAIT SHELTER-Square Meters (SF)
- (16) (690-432) FLAGPOLE-(EA; dimensions)
- (17) (93210) SITE IMPROVEMENT-(JOB)
- (18) (93220) LANDSCAPE PLANTING (Hectare (Acre); EA; Square Meters (SF))
- (19) (93230) LANDSCAPE BERMS/MOUNDS-Square Meters (SY)
- (20) (93410) CUT AND FILL-Cubic Meters (CY)
- (21) (843-315) FIRE HYDRANTS-(EA; Type)
- (22) (14970) LOADING AND UNLOADING DOCKS AND RAMPS (not connected to a Bldg)-Square Meters (SF) (23) BICYCLE RACK-(EA)
- (24) (85140/812-928) TRAFFIC SIGNALS-(EA)
- (25) (87210) FENCING OR WALLS-Lineal Meters (LF)
- (26) (15432) RIPRAP-Lineal Meters & Square Meters (LF & SY)
- (27) (75061) GRANDSTAND OR BLEACHERS-(EA; SE)
- (28) 87150/871-187) RETAINING WALLS-Lineal Meters; Square Meters (LF; SY); material

NOTE: 5 Digit Codes-Army; 6 Digit Codes-Air Force

END OF SECTION





## SECTION 01705

### EQUIPMENT-IN-PLACE LIST

#### PART 1 GENERAL

##### 1.1 SUBMITTALS

Data listed in PART 3 of this section shall be submitted in accordance with Section SUBMITTAL PROCEDURES. Due dates shall be as indicated in applicable paragraphs and all submittals shall be completed before final payment will be made.

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 Submittal:

The final equipment-in-place list shall be completed and returned to the Contracting Officer within 30 calendar days of the final inspection. The Contracting Officer will review all final Equipment-In-Place Lists for accuracy and conformance to the requirements contained in DIVISION 1 GENERAL REQUIREMENTS. The lists shall be returned to the Contractor if corrections are necessary. The Contractor shall make all corrections and shall return the lists to the Contracting Officer within 7 calendar days of receipt.

##### 3.2 EQUIPMENT-IN-PLACE LIST:

Contractor shall submit for approval, at the completion of construction, a list of equipment-in-place. This list shall be updated and kept current throughout construction, and shall be jointly inspected for accuracy and completeness by the Contracting Officer's representative and a responsible representative of the Contractor prior to submission of each monthly pay estimate. A sample form showing minimum data required is provided at the end of this section. The EQUIPMENT-IN-PLACE LIST shall be comprised of all equipment falling under one or more of the following classifications:

- a. Each piece of equipment listed on the mechanical equipment schedules.
- b. Each electrical panel, switchboard, and MCC panel.
- c. Each transformer.
- d. Each piece of equipment or furniture designed to be movable.
- e. Each piece of equipment that contains a manufacturer's serial number on the name plate.
- f. All Government furnished, Contractor installed equipment per a. through e. (price data excluded)

This information shall be listed in the RMS CQC Module furnished by the Government under the “Installed Property” menu selection.

### 3.3 PAYMENT

All costs incurred by the Contractor in the preparation and furnishing of Equipment-In-Place Lists shall be included in the contract price and no separate payment will be made for this work. Approval and acceptance of the final Equipment-In Place Lists shall be accomplished before final payment is made to the Contractor.

### 3.4 RMS CQC SOFTWARE MODULE

The Contractor is required to use the RMS CQC Software module to manage the above required Equipment-In-Place data. See specification Section 01451 CONTRACTOR QUALITY CONTROL, paragraph IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM FOR CONTRACTOR QUALITY CONTROL OF CONTRACT.

**EQUIPMENT-IN-PLACE LIST**

**CONTRACT NO.:** \_\_\_\_\_

Specification Section: \_\_\_\_\_ Paragraph No. \_\_\_\_\_

**ITEM DESCRIPTION:** \_\_\_\_\_

Item Name: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Model Number: \_\_\_\_\_

Capacity: \_\_\_\_\_ Replacement Cost \_\_\_\_\_

**ITEM LOCATION:**

Building Number: \_\_\_\_\_ Room Number: \_\_\_\_\_

or Column Location: \_\_\_\_\_

**MANUFACTURER INFORMATION:**

Manufacturer Name: \_\_\_\_\_

Trade Name (if  
different from item name): \_\_\_\_\_

Manufacturer's Address: \_\_\_\_\_  
\_\_\_\_\_

Telephone Number: \_\_\_\_\_

**WARRANTY PERIOD:** \_\_\_\_\_

CHECKED BY: \_\_\_\_\_

END OF SECTION



## SECTION 02050

### DEMOLITION

#### PART 1 GENERAL

##### 1.1 PROTECTION

- A. Streets, roads, adjacent property and other work to remain shall be protected throughout the work.
- B. Any material damaged by Contractor's operations shall be replaced with new material by the Contractor.

##### 1.2 REMOVAL OF STRUCTURES, STAIRS AND CONCRETE

- A. The Contractor shall raze, remove, and dispose of all buildings and foundations, structures, stairs, fences, and other obstructions that are indicated in the drawings.
- B. Remove foundations below finished subgrade elevation.
- C. Fill cavities left by the removal of structures to match the level of surrounding ground.
- D. Any material not designated as the Owner's property will belong to the Contractor. Disposal shall be off-site at an approved dump location.

##### 1.3 MAPLE TREE

- A. Cut down maple tree as shown on the drawings. Remove stump and roots to two feet below finished grade. Contractor shall haul off and dispose of debris to an approved dump location.

##### 1.4 ROCK WALL

- A. Remove existing rock wall as shown on the drawings. Rock, if suitable, may be re-used for closure at the stairwell to the north.

END OF SECTION

99020/AN  
FORT LAWTON PHASE TWO

083001

## SECTION 02161

### ROCK WALLS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Rockery for rock walls.
- B. Ballast rock backfill.

##### 1.2 RELATED SECTIONS

- A. Section 02225 - Earthwork for Roadways, Railroads and Airfields.
- B. Section 02711 - Foundation Drainage System

##### 1.3 SUBMITTALS

- A. Location of quarry where the proposed materials are to be secured.

##### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Unload and stockpile rockery rock at site to segregate the rock by size range.

#### PART 2 PRODUCTS

##### 2.1 ROCKERY ROCK

- A. Hard, sound and durable.
- B. Free from segregation, seams, cracks and other defects tending to destroy its resistance to weather.
- C. Density of at least 155 pounds per cubic foot.
- D. Nearly rectangular as possible.
- E. Uniform in size for each size.
- F. Rock for top 3 feet range in size from 400-800 pounds. Each lower 3 feet zone shall be 400 pounds heavier than the rock in the upper zone.

## 2.2 BALLAST ROCK BACKFILL

- A. Same material as rock material except shall consist of quarry spalls.
- B. Maximum size - six inches.
- C. Minimum size - two inches.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Excavate a trench for placement of rockery below subgrade in excavation sections or below the existing ground level in embankment sections.
- B. Areas on which the rockery is to be placed shall be trimmed and dressed to conform to the elevation or slope indicated.
- C. Construction will start as soon as possible upon the shaping of the cut or fill section.

### 3.2 ROCK PLACEMENT

- A. Rocks shall be carefully placed by mechanical equipment and in a manner such that the longitudinal axis of the rock shall be at right angles or perpendicular to the rock wall face. Lace new rockery into existing rockery and tie to the stairwell to form a complete wall system.
- B. Larger rocks shall be placed at the base of the wall so that the wall will be stable and have a stable appearance.
- C. Rocks shall have all inclining faces sloping to the back of the rockery.
- D. Each row of rocks will be sated as tightly and evenly as possible on the rock below in such a manner that there will be no movement between the two.
- E. Rock selection and placement shall be such that there will be no open voids in the exposed face of the wall over six (6) inches across in any direction.
- F. Rocks shall be placed and keyed together with a minimum of voids.
- G. Voids between the rocks shall be chinked on the back with ballast rock to eliminate any void sufficient to pass a 2-inch square probe.



- H. Final course shall have a continuous appearance and be placed to minimize erosion of the backfill material.
- I. Maximum of six inch tolerance permitted between the designated slope plane and the finished wall.
- J. Construct wall one course at a time in embankment areas as adjoining embankment is constructed.

### 3.3 WALL BACKFILL

- A. Place ballast rock behind the rockery and the cut or fill material after each course of rocks.
- B. Place in lifts to an elevation approximately six (6) inches below the course of rocks placed.
- C. Backfill material on the bearing surface of the rock course will be removed before setting the next course.

### 3.4 REJECTED AND UNUSED MATERIAL

- A. Remove all rejected and unused material after construction of the rock walls.

END OF SECTION

99020/AN  
FORT LAWTON PHASE TWO

083001

## SECTION 02221

### EXCAVATING, FILLING, BACKFILLING, AND GRADING FOR BUILDINGS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Excavating, filling and backfilling for buildings. Site grading and grading for buildings.

##### 1.2 REFERENCES

- A. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft)
- B. ASTM D 1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- C. ASTM D 2487 - Soils for Engineering Purposes (Unified Soil Classification System)
- D. ASTM D 2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- E. ASTM D-2419 - Sand Equivalent Value of Soils and Fine Aggregate
- F. ASTM D-1621 - Compressive Properties of Rigid Cellular Plastics
- G. ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions.
- H. ASTM C 136 – (1992) Sieve Analysis of Fine and Coarse Aggregates
- I. ASTM D 422 – (1963; R 1990) Particle-Size Analysis of Soils

##### 1.3 SUBMITTALS: Submit under provisions of Division 1.

- A. Material gradation test reports.
- B. Moisture density compaction curves test reports.
- C. Qualifications of the commercial testing laboratory.

D. Notification

Advance notice on the opening of excavation.

E. Procedure and location for disposal of unused material, including haul routes.

F. At any time, should the Contractor change the source and/or stockpile from which materials are obtained, certificates of gradation for these new sources will also be required. The Contractor shall make allowances in his bid for these items to cover expenses incurred in having this certification made and no additional compensation will be allowed.

E. During construction, the Contracting Officer may elect to have further gradation testing completed on the materials being furnished by the Contractor. This testing will be at the expense of the Contracting Officer; however, the Contractor shall provide material samples as may be necessary to complete this testing and these material samples will be furnished from material available on the job site or from the Contractor's source and/or supplier.

1.4 QUALITY ASSURANCE

A. Soils and Backfill: Moisture density standard ASTM D1557.

B. In-place Density Determination: Sandcone method ASTM D1556 or Nuclear method ASTM D2922.

C. Classification of Soils: ASTM D2487.

D. Quality control monitoring of backfill, fill and embankment materials and construction by certified independent laboratory approved by Contracting Officer and secured and paid for by the Contractor.

1.5 CLASSIFICATION

A. All excavation is unclassified.

B. The terms earthwork or excavation include all materials excavated or removed regardless of material characteristics.

C. The Contractor shall make his own estimate based on conditions stated in accompanying Geotechnical report and logs.

## 1.6 BLASTING

Blasting will not be permitted.

## PART 2 PRODUCTS

### 2.1 BACKFILL GRAVEL

- A. Backfill gravel shall consist of naturally occurring screened or crushed gravel.
- B. Be essentially free from wood waste or other extraneous or objectionable materials.
- C. Shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value	72 min.
Swell Pressure	0.3 psi max.
Maximum Particle Size	3 in.
Passing 1/4" Sq. Opening	25% min.
Passing No. 200 Sieve	
All percentages are by weight	

Dust ratio:	% Passing No. 200 Sieve	2/3 max.
	% Passing No. 40 Sieve	
Sand Equivalent (ASTM D2419)		30 min.

- D. Backfill gravel material retained on a 1/4 inch square sieve shall contain not more than 0.20% by weight of wood waste.
- E. The Contractor shall provide the Contracting Officer with a certificate of gradation or sieve analysis from a qualified testing laboratory for backfill gravel furnished under this contract.

### 2.2 GRANULAR BASE MATERIAL

- A. Granular base material for use under slabs on grade or footings as shown on the drawings shall be a clean screened or crushed sand/gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D422:

Sieve Size	Percent Passing
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<u>Square Opening</u>	<u>By Weight</u>
1-1/4 inch	100
5/8 inch	50 - 80
No. 4	30 - 50
No. 40	3 - 18
No. 200	7.5 max.

Minimum sand equivalent shall equal 40.

### PART 3 EXECUTION

#### 3.1 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project, to the lines, grades, and elevations indicated and as specified herein. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Excavated materials shall be disposed of off-site. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. The Contractor shall furnish an affidavit of legal disposal of such material in a form acceptable to the Contracting Officer. Unsatisfactory excavated material shall be disposed of at an off-site location as determined by the Contractor. The Contractor shall furnish an affidavit of legal disposal of such material in a form acceptable to the contracting officer. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. The Contractor shall excavate to a depth of 1 foot below base of all footings.

#### 3.2 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 95 percent laboratory maximum density in such a manner as to prevent wedging action or eccentric loading upon or against any structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS AND EMBANKMENTS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted.

#### 3.3 FILLING

- A. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed, shall be plowed, stepped (benched), or broken up in such manner that the fill material will bond with the existing surfacing.
- B. The original ground surface shall be plowed or scarified to a depth of at least six (6) inches and compacted as specified herein, except those areas on which foundations will be placed.
- C. Soft, wet soils shall be excavated and replaced or allowed to dry before placing fill.
- D. Slabs on Grade

Structural fills under building slabs on grade shall be constructed from granular base material approved by the Contracting Officer. Fills shall be placed in 9-inch lifts and compacted to 95 percent of maximum dry density.

### 3.4 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

### 3.5 FOUNDATIONS

Foundations shall be constructed on Granular Fill Material. Foundation excavation shall be neat lined to elevations as indicated on the plans. Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall refill such excavated space to the proper elevation with granular material. Backfill shall be made at no cost to the government.

### 3.6 EMBANKMENTS

- A. Earth Embankments

Earth embankments shall be constructed from backfill gravel. The material shall be placed in successive horizontal layers of loose material not more than 12 inches in depth. Each

layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted.

### 3.7 FINISH GRADING

The surface of all excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for all graded areas shall be within 1 foot of the grades and elevations indicated.

### 3.8 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017, the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and in intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements, at no additional expense to the Government. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil Contracting Officer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the Contracting Officer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### A. Fill and Backfill Material Gradation



One test per 150 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136.

**B. In-Place Densities**

1. One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
2. One test per 250 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
3. One test per 50 linear feet, or fraction thereof, of each lift of fill or backfill for foundations.

**C. Check Tests on In-Place Densities**

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

1. One check test per lift for each 2500 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
2. One check test per lift for each 1000 square feet, of fill or backfill areas compacted by hand-operated machines.

**D. Moisture Contents**

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

**E. Optimum Moisture and Laboratory Maximum Density**

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

**F. Tolerance Tests for Subgrades**

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

### 3.9 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or foundation is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, or foundation shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, or concrete be placed on a muddy, spongy, or frozen subgrade.

END OF SECTION

## SECTION 02222

### EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Excavation, trenching and backfilling for sanitary sewer, water, storm drain and foundation drain systems.

##### 1.2 RELATED SECTIONS

- A. Section 02660 - Water Lines
- B. Section 02711 - Foundation Drainage Systems
- C. Section 02720 - Storm Drainage System
- D. Section 02730 - Sanitary Sewers

##### 1.3 REFERENCES

- A. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft)
- B. ASTM D 1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- C. ASTM D 2487 - Soils for Contracting Officer's Purposes (Unified Soil Classification System)
- D. ASTM D 2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- E. ASTM D-2419 - Sand Equivalent Value of Soils and Fine Aggregate
- F. ASTM D-1621 - Compressive Properties of Rigid Cellular Plastics
- G. ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions.

##### 1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Material gradation test reports.
- B. Moisture density compaction curves test reports.
- C. At any time, should the Contractor change the source and/or stockpile from which materials are obtained, certificates of gradation for these new sources will also be required. The Contractor shall make allowances in his unit prices bid for these items to cover expenses incurred in having this certification made and no additional compensation will be allowed.
- D. During construction, the Contracting Officer may elect to have further gradation testing completed on the materials being furnished by the Contractor. This testing will be at the expense of the Contracting Officer; however, the Contractor shall provide material samples as may be necessary to complete this testing and these material samples will be furnished from material available on the job site or from the Contractor's source and/or supplier.

#### 1.5 QUALITY ASSURANCE

- A. Soils and Backfill: Moisture density standard ASTM D1557 method unless otherwise specifically approved.
- B. In-place Density Determination: Sandcone method ASTM D1556 or Nuclear method ASTM D2922.
- C. Classification of Soils: ASTM D2487.
- D. Quality control monitoring of subgrade backfill and embankment materials and construction by certified independent laboratory approved by Contracting Officer and secured and paid for by the Contractor.

#### 1.6 CLASSIFICATION

- A. All excavation is unclassified.
- B. The terms earthwork or excavation include all materials excavated or removed regardless of material characteristics.
- C. The Contractor shall make his own estimate of the kind and extent of materials which will be encountered in the excavation.

## PART 2 PRODUCTS

### 2.1 SUITABLE NATIVE MATERIAL

- A. These materials shall be native materials free from roots or other organic material, debris or frozen material suitable for re-use as backfill in the specific application as determined by the Contracting Officer.

### 2.2 SELECT FILL MATERIAL

- A. These materials shall be suitable native materials free from roots or other organic material, debris or frozen material which are processed to remove stone larger than 3 inches in diameter and to achieve uniform texture and moisture content.

<u>Sieve Size</u>	<u>% Passing by Weight</u>
3 inches	100
No. 4	35-70
No. 200	0-15

### 2.3 GRAVEL BEDDING

- A. Gravel bedding material shall be a clean screened or crushed sand/gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ATM D422:

<u>Sieve Size</u> <u>Square Opening</u>	<u>Percent Passing</u> <u>By Weight</u>
3/4 inch	100
3/8 inch	70 - 100
No. 4	55 - 100
No. 10	35 - 95
No. 20	20 - 80
No. 40	10 - 55
No. 100	0 - 10
No. 200	0 - 3

- B. Minimum sand equivalent shall be 35 in accordance with ASTM D2419.

## 2.4 PEA GRAVEL

- A. Pea gravel shall consist of clean, granular processed gravel with the following gradation requirements:

<u>Sieve Size</u> <u>Square Opening</u>	<u>Percent Passing</u> <u>By Weight</u>
3/4 inch	100
3/8 inch	95 - 100
No. 8	0 - 10
No. 200	0 - 3

- B. Minimum sand equivalent shall be 50 in accordance with ASTM D2419.

## 2.5 BACKFILL GRAVEL

- A. Backfill gravel shall consist of naturally occurring screened or crushed gravel.
- B. Be essentially free from wood waste or other extraneous or objectionable materials.
- C. Shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value	72 min.
Swell Pressure	0.3 psi max.
Maximum Particle Size	3 in.
Passing 1/4" Sq. Opening	25% min.
Passing No. 200 Sieve	
All percentages are by weight	

Dust ratio: % Passing No. 200 Sieve	2/3max.
% Passing No. 40 Sieve	
Sand Equivalent (ASTM D2419)	30 min.

- D. Backfill gravel material retained on a 1/4 inch square sieve shall contain not more than 0.20% by weight of wood waste.
- E. The Contractor shall provide the Contracting Officer with a certificate of gradation or sieve analysis from a qualified testing laboratory for backfill gravel furnished under this contract.

## 2.6 FOAM ISOLATION PAD

- A. Isolation pad shall be closed-cell, extruded polystyrene foam.
- B. Minimum compressive strength of 25 psi when tested in the vertical direction in accordance with ASTM D1621.
- B. Maximum water absorption of 0.3% by volume when tested in accordance with ASTM C272.

## 2.7 DETECTOR LOCATOR TAPE

- A. Tape shall consist of a minimum 5.0-mil thickness of plastic encased aluminum foil. The tape shall have a minimum thickness of 1.0 mil laminated on both sides by 2.0-mil thick plastic. Tape shall be at least three inches (3#) in width and shall conform to APWA color-coding standards with identifying print in black letters. Each tape shall have printed thereon the following or similar as commercially available:

“CAUTION – BURIED WATER LINE BELOW”

“CAUTION – BURIED SEWER LINE BELOW”

“CAUTION – BURIED POWER LINE BELOW”

“CAUTION – BURIED GAS LINE BELOW”

“CAUTION – BURIED COMMUNICATIUNO LINE BELOW”

The identifying letters shall be minimum one inch (1”) high and repeated continuously the full length of the tape. In no instance shall the spacing of the individual segment of the identifying message be greater than eighteen inches (18”).

- B. Detector locator tape shall be installed twelve inches (12” below surface of the ground above the surface of the pipe it identifies. The backfill shall be sufficiently leveled so that the tape will be installed on a flat surface. The tape shall be centered in the trench and laid flat with the printed side up. Caution shall be exercised to avoid displacement of tape and to ensure its integrity. The remainder of the trench is then backfilled in accordance with applicable specifications.

## PART 3 EXECUTION

### 3.1 TRENCHING

- A. Material shall be excavated from trenches and piled adjacent to the trench and maintained so that the toe of the slope of the spoil material is at least two (2) feet from the edge of the trench.
- B. Free access shall be provided to all fire hydrants, water valves and meters, and clearance shall be left to enable the free flow of storm water in all gutters, conduits, and natural water courses.
- C. Contractor shall keep excavations free of water.

### 3.2 TRENCHING FOR WATER LINES

- A. Trenching shall be dug to true and smooth bottom grades in accordance with the lines given on the drawings.
- B. Trench widths shall not exceed 30 inches or 1.5 times outside diameter of the pipe plus 18 inches, whichever is greater.
- C. Standard excavation equipment shall be adjusted so as to excavate the narrowest ditch possible.
- D. Depth of trenching for water mains shall be such as to give a minimum cover of 3'-6" over the top of the pipe unless otherwise specified.
- E. Deeper excavation may be required due to localized breaks in grade, or to install the new main under existing culverts or other utilities where necessary.
- F. Where profile of pipeline and ground surface is shown on the plans, pipeline shall be laid to elevation shown, regardless of depth.
- G. Excavation shall be to such depth that the minimum cover over the valve nuts shall be one foot.
- H. The length of trench excavated in advance of pipe laying shall be kept to a minimum and in no case shall length of open trench exceed 400 feet unless specifically authorized by the Contracting Officer.



- I. Trenches shall be over excavated below the specified grade to provide for bedding material specified.

### 3.3 TRENCHING FOR SEWERS AND STORM DRAINS

- A. Trenches must be of sufficient width to permit proper jointing of the pipe and backfilling of material along the sides of the pipe.
- B. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner.
- C. Trenches wider than the maximum specified may result in a greater load of overburden than the pipe is designed for, and consequently, if the maximum trench width is exceeded by the Contractor, the Contractor shall, at his own expense, provide pipe of higher strength classification, or provide a higher class of bedding where necessary to assure that the pipe will not be overloaded.
- D. The normal maximum permissible trench width, at the bottom of the trench and up to a point at the crown of the pipe, shall be 1.5 times the inside diameter plus 18 inches or 40 inches, whichever is greater.
- E. Excavation for manholes and other structures shall be sufficient to provide a minimum of 12 inches between their outside surfaces and the sides of the excavation.
- F. The length of trench excavated in advance of the pipe laying shall be kept to a minimum, and, in no case, shall it exceed 150 feet unless specifically authorized by the Contracting Officer.
- G. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for bedding material specified.

### 3.4 TRENCHING FOR GAS LINES

- A. Trenching shall be coordinated with Puget Sound Energy. Contact Rem Husted (Phone Number: (425) 447-3146) to coordinate excavation by Contractor and installation of pipe by Puget Sound Energy. Following installation of pipe by Puget Sound Energy, the Contractor shall place bedding and backfill for gas pipe per the Plans and Specifications.
- B. Trenching shall be dug to true and smooth bottom grades in accordance with the lines given on the drawings.
- C. Trench widths shall be 24" minimum and 30" maximum or as shown on the drawings.

- D. Standard excavation equipment shall be adjusted as necessary to excavate the ditch to widths as specified herein.
- E. Depth of trenching for gas lines shall be such as to give a minimum cover of 3'-0" over the top of the pipe unless otherwise specified.
- F. Deeper excavation may be required due to localized breaks in grade, or to install the new main under existing culverts or other utilities where necessary.
- G. The length of trench excavated in advance of pipe laying shall be kept to a minimum and, in no case, shall length of open trench exceed 400 feet unless specifically authorized by the Contracting Officer.
- H. Trenches shall be over excavated below the specified grade to provide for bedding material specified as shown on the Plans.

### 3.5 FOUNDATION DRAINS

- A. Install foundation drains for walls and building prior to backfilling.

### 3.6 PIPE BEDDING

- A. Place gravel bedding material in the pipe zone as shown on the details.

### 3.7 BACKFILL GRAVEL

- A. Backfill gravel shall only be placed at the locations shown on the drawings or at locations directed by the Contracting Officer.
- B. Surplus material due to importation of backfill gravel shall be hauled off site for disposal.

### 3.8 BACKFILLING

- A. Pipe shall be completely bedded before backfilling operations are started.
- B. The Contractor shall take all necessary precautions to protect the pipe from any damage, movement or shifting. In general, backfilling shall be performed by pushing the material from the end of the trench into, along and directly over the pipe so that the material will be applied in the form of a rolling slope rather than by side filling which may damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as to protect the pipe.
- C. Compaction equipment used above the pipe zone shall be of a type that does not injure the pipe.
- D. Provide for the proper maintenance of traffic flow and accessibility as may be necessary.
- E. Make adequate provisions for the safety of property and persons.
- F. Temporary shoring shall be removed unless specifically authorized in writing.
- G. Trenches shall be dewatered during backfilling.
- H. Where it is required that a blanket of select fill material or backfill gravel be placed on top of the native backfill, the backfill shall be placed to the elevations shown on the Plans, or to the elevation the Contracting Officer may direct, and shall be leveled to provide for a uniform thickness of the select material. Compaction of the native material shall be as specified.
- I. Metallic locator tape shall be installed in accordance with applicable specifications.

### 3.9 GENERAL COMPACTION REQUIREMENTS

- A. When working in an existing traveled roadway, restoration and compaction must be achieved as the trench is backfilled so as to maintain traffic.
- B. Trench backfill under roadway shall be mechanically compacted to 95% of maximum density unless shown on the plans to be compacted to a higher percentage of maximum density.

### 3.10 MECHANICAL COMPACTION

- A. Method of compaction shall be at Contractor's option.
- B. The Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density.
- C. In place compaction tests shall be made. Contractor shall remove and recompact material that does not meet specified requirements.

END OF SECTION

SECTION 02225

EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1992) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1140	(1992) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1984; R 1990) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1992) Classification of Soils for Contracting Officer's Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1983; R 1990) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988) Water Content of Soil and Rock in by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1984) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

A. Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, SW, or SP.

B. Unsatisfactory Materials

Unsatisfactory materials shall comprise any materials classified by ASTM D 2487 as Pt, OH, OL, ML, CL, MH, CH.

C. Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.1.4.4

D. Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 . This will be abbreviated below as a percent of laboratory maximum density.

1.3 SUBMITTALS

A. Earthwork

Procedure and location for disposal of unused satisfactory material.

B. Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

C. Qualifications

Qualifications of approved independent commercial testing laboratory.

D. Notification

Advance notice on the opening of excavation. Advance notice on shoulder construction for rigid pavements.

1.4 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

## 1.5 BLASTING

Blasting will not be permitted.

## 1.6 UTILIZATION OF EXCAVATED MATERIALS

# PART 2 PRODUCTS

## 2.1 CRUSHED ROCK BASE COURSE

Crushed rock shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 3-01 of Standard Specifications for Road, Bridge, and Municipal Construction. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following minimum test requirements:

Los Angeles Wear, 500 Rev.	35% max.
Degradation Factor-Base Course	15% min.

Crushed rock of the base course shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance shall be determined by the Contracting Officer.

<u>Sieve Size</u>	<u>Percent Passing</u>
1-1/4" square	100
5/8" square	50 – 80
1/4" square	30 – 50
U.S. No. 40	3-18
U.S. No. 200	7.5 max.
% Fracture	75 min.
Sand Equivalent	40 min.

All percentages are by weight. The fracture requirement shall be at least one fractured face and will apply to material retained on each specification sieve size U.S. No. 10 and above if that sieve retains more than 5 percent of the total sample. The portion of crushed rock retained on a 1/4" sieve shall not contain more than 0.15 percent wood waste.

### 3.1 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project, to the lines, grades, and elevations indicated and as specified herein. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of off-site. Unsatisfactory excavated material shall be disposed of off-site outside of government controlled land by the Contractor. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times.

#### A. Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Care shall be taken not to excavate ditches and gutters below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory thoroughly compacted material or with suitable stone or cobble to grades shown at no additional cost to the Government. Material excavated shall be disposed of off-site, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain all excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

#### B. Drainage Structures

Excavations shall be made accurately to the lines, grades, and elevations shown or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

### 3.2 GRADING AREAS

When so provided and where indicated, work under contract will be divided into grading areas, within which satisfactory excavated material shall be placed in embankments, fills,



and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

### 3.3 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, in such a manner as to prevent wedging action or eccentric loading upon or against any structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, below and Section 02720 STORM-DRAINAGE SYSTEM; and Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted.

### 3.4 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

### 3.5 EMBANKMENTS

#### A. Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. The material shall be placed in successive horizontal layers of loose material not more than 12 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density. Compaction requirements

## FORT LAWTON PHASE TWO

for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted.

### 3.6 SUBGRADE PREPARATION

#### A. Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviation greater than 1.75 inches when tested with a 16 foot straightedge applied both parallel and at right angles to the centerline of the area.

#### B. Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted.

##### 1. Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 98 percent of the laboratory maximum density for 6" below the base course of the pavement shown.

##### 2. Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percent of the laboratory maximum density for the full depth of the shoulder.

### 3.7 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow materials or as otherwise shown or specified herein. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be

constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

### 3.8 FINISHING

The surface of all excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for all graded areas shall be within 30 mm (0.1 foot) of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION above. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

### 3.9 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017, the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and in intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements, at no additional expense to the Government. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil Contracting Officer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the Contracting Officer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

A. Fill and Backfill Material Gradation

One test per 150 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136.

B. In-Place Densities

1. One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
2. One test per 250 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
3. One test per 150 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.
4. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for railroads.

C. Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

1. One check test per lift for each 2500 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
2. One check test per lift for each 1000 square feet, of fill or backfill areas compacted by hand-operated machines.
3. One check test per lift for each 300 linear feet, or fraction thereof, of embankment or backfill for roads.
4. One check test per lift for each 200 linear feet, or fraction thereof, of embankment or backfill for railroads.

D. Moisture Contents

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

E. Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

F. Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.10 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

END OF SECTION

99020/AN  
FORT LAWTON PHASE TWO

083001

## SECTION 02241

### BASE COURSE

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C29M	(Rev A, 1991) Unit Weight and Voids in Aggregate
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 127	(1988) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1993) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1989) Resistance to Degradation of Small-Size Coarse Aggregate By Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; Rev 1992) Sampling Aggregates
ASTM D 422	(1963; Rev 1992) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil In-Place by the Sand-Cone Method
ASTM D 1557	(1991) Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Lb. (4.54-kg) Rammer and 18-In. (457-mm) Drop
ASTM D 2167	(1994) Density and Unit Weight of Soil In-Place by the Rubber Balloon Method
ASTM D 4318	(1995) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEFINITIONS

### 1.2.1 Crushed Rock Base

Crushed Rock Base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

### 1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method D, abbreviated hereinafter as percent laboratory maximum density.

## 1.3 GENERAL

The work specified herein consists of the construction of a crushed rock base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans.

## 1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTALS:

SD-70, Test Reports

Results of laboratory tests specified under paragraph Aggregates shall be submitted to the Contracting Officer and approved prior to using the material. Tests shall show liquid limit, plasticity index, soundness, wear, fractured faces, and sieve analysis tests including percentage of particles having diameters less than .02 mm.

Copies of field test results shall be submitted within 24 hours after the tests are performed.

## 1.5 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 35 degrees F. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 35 degrees F, completed areas shall be protected against any detrimental effects of freezing.

## 1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

### 1.6.1 General Requirements



Plant, equipment, machines, and tools used in the work shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

#### 1.6.2 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

#### 1.6.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 10 foot straightedge for use in the testing of the finished surface. Straightedge shall be made available for Government use.

### 1.7 SAMPLING AND TESTING

#### 1.7.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory. No work requiring testing shall be permitted until the facilities have been inspected and approved. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor.

#### 1.7.2 Test Results

Results shall verify that materials comply with this specification. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified to meet specification requirements.

#### 1.7.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with ASTM D 75.

#### 1.7.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11.

### 1.7.5 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

### 1.7.6 Laboratory Density

Tests shall provide a moisture-density relationship for the crushed rock. Tests shall be conducted in accordance with ASTM D 1557, Method D.

### 1.7.7 Wear Tests

Wear tests shall be performed in accordance with ASTM C 131.

### 1.7.8 Sampling and Testing During Construction

Quality control sampling and testing during construction shall be performed as specified in section "CONTRACTOR QUALITY CONTROL."

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, angular sand, or other approved materials. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Material retained on a No. 4 sieve shall be known as coarse aggregate and that passing the No. 4 sieve shall be known as binder material.

##### 2.1.1.1 Coarse Aggregate

Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with ASTM C 131. The coarse aggregate shall not have a loss greater than 15 percent weighted average at five cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

a. Crushed Gravel: Crushed gravel shall be manufactured from gravel particles 50 percent of which by weight are retained on the maximum size gradation sieve specified.

b. Crushed Stone: Crushed stone retained on each sieve specified shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with

the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as two fractured faces.

#### 2.1.1.2 Binder Material

Binder material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

#### 2.1.2 Gradation

Requirements for gradation specified shall apply to the completed base course. The aggregates shall be continuously graded within the following limits:

Sieve Designation	Percentage by Weight Passing Square-mesh Sieve
1-1/2-inch	100
1-inch	60-100
1/2-inch	30-65
No. 4	20-50
No. 10	15-40
No. 40	5-25
No. 200	0-[10]

The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves are subject to appropriate correction in accordance with ASTM C 127 and ASTM C 128 when aggregates of varying specific gravities are used.

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the area to be stabilized. Line and grade stakes shall be

provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

### 3.2 PREPARATION OF UNDERLYING COURSE

#### 3.2.1 General Requirements

Before constructing crushed rock base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

#### 3.2.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required crushed rock base course thickness so that the finished crushed rock base course with the subsequent surface course will meet the fixed grade. Finished and completed base course shall conform to the lines, grades, cross section, and dimensions indicated.

### 3.3 INSTALLATION

#### 3.3.1 Mixing and Placing

Materials shall be mixed and placed in such a manner as to obtain uniformity of the crushed rock base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory base course.

#### 3.3.2 Edges of Base Course

Approved material shall be placed along edges of crushed rock base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 1-foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

#### 3.3.3 Compaction

Each layer of crushed rock base course including shoulders shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 98

percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

### 3.3.4 Layer Thickness

Compacted thickness of the crushed rock base course shall be as indicated. No layer shall be in excess of 8 inches nor less than 3 inches in compacted thickness.

### 3.3.5 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompact, or replaced as directed.

#### 3.3.5.1 Smoothness

Surface of each layer shall show no deviations in excess of 3/8 inch when tested with the 10-foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

#### 3.3.5.2 Thickness Control

Compacted thickness of the crushed rock base course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompact as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated.

## 3.4 FIELD QUALITY CONTROL

### 3.4.1 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167.

### 3.4.2 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 10 foot straightedge. Measurements shall also be taken perpendicular to the road centerline at 50 foot intervals.

### 3.4.3 Thickness

The completed thickness of the base course shall be within 1/2 inch of the thickness indicated. The thickness of the base course shall be measured at intervals providing at least one measurement for at least each 500 square yards of base course. The depth measurement shall be made by test holes at least 3 inches in diameter. Where the measured thickness of the base course is more than 1/2 inch deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 1/2 inch more than indicated, it will be considered as conforming with the requirements plus 1/2 inch, provided the surface of the base course is within 1/2 inch of established grade. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness indicated.

## 3.5 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

## 3.6 MAINTENANCE

The crushed rock base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

## 3.7 DISPOSAL OF UNSATISFACTORY MATERIALS

Material that is removed for the required correction of defective areas and waste material and debris shall be disposed of off site.

END OF SECTION

## SECTION 02275

### TEMPORARY EROSION CONTROL

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Temporary Erosion and Sedimentation Controls Measures required during construction.

##### 1.2 RELATED SECTIONS

- A. Divisional - General Conditions - Submittals
- B. Section 02225 - Earthwork for Roadways, Railroads and Airfields
- C. Section 02720 - Storm Drainage System
- D. Section 02950 - Trees, Plants and Ground Cover

##### 1.3 QUALITY CONTROL

- A. Conform to local regulatory requirements and the temporary erosion control plan.

##### 1.4 SUBMITTALS

- A. Submit a Temporary Erosion Control Plan for review and approval in accordance with provisions of Division 1. The Plan shall explain in writing and detail on drawings the measures, methods and facilities which the Contractor shall install to provide temporary erosion control. The items shown on the Temporary Erosion Control Plan shall be considered the minimum. The Contracting Officer reserves the right to order additional temporary erosion control measures be installed if, in his opinion, it becomes necessary during the course of construction due to changes in weather, performance of in place measures, changes in the Contractor's construction methods or for any other reason. Such additional measures, if so ordered, will be at the Contractor's sole expense.

## 1.5 REQUIREMENTS

- A. The required sedimentation control facilities must be constructed and in operation prior to land clearing and/or other construction to ensure that erosion is minimized and that sediment laden water does not enter the natural or existing drainage systems.
- B. Sediment facilities shall be maintained in a satisfactory condition until such time that clearing and/or construction is completed and potential for on-site erosion has passed.
- C. The implementation, maintenance, replacement and additions to erosion/sedimentation control systems shall be the responsibility of the Contractor.

## PART 2 PRODUCTS

### 2.1 HYDROSEEDING

- A. Hydroseeding shall conform to the requirements of Section 02950.

### 2.2 STRAW

- A. Be in an air dried condition free of noxious weeds, weed seeds, and other materials detrimental to plant life.
- B. Be seasoned before baling or loading and shall be acceptable to the Engineer.

### 2.3 JUTE MATTING

- A. Be of a uniform open plain weave of unbleached, single jute yard treated with a fire retardant chemical.
- B. The yard shall be of a loosely twisted construction and shall not vary in thickness by more than 1/2 of its normal diameter.
- C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.
- D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5% in weight.



## 2.4 FILTER FABRIC

- A. Filter fabric for the erosion protection barriers shall be non-woven fabric with a minimum grab strength of 120 lbs., Minimum puncture strength of 240 lbs., and a water flow rate of 140 gpm/sf.

## 2.5 WIRE

- A. Wire for the erosion protection barriers shall be 2 x 2 mesh, 14 gauge galvanized wire.

## 2.6 SUPPORT POSTS

- A. Support posts for the erosion protection barriers shall be 20 inch by 4-inch, Doug-FR. No. 1 or better wood posts or 1-1/2 inch by 4/8-inch medium weight steel fence posts.

## 2.7 CLEAR PLASTIC COVERING

- A. Clear plastic covering for protection of slopes and cuts shall meet the requirements of the NBS Voluntary Product Standard, PS 17 for Polyethylene sheeting having a minimum thickness of 6 mil.

# PART 3 EXECUTION

## 3.1 EROSION CONTROL

- A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.
- B. The provisions specified in the Temporary Erosion Control Plan are the minimum requirements.
- C. Contractor shall not permit sediment laden waters to enter drainage facilities.
- D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the Contractor to address new conditions that may be created and to provide additional facilities over and above minimum requirements as may be required.

## 3.2 SILTATION/SEDIMENTATION PONDS

- A. Siltation/sedimentation ponds shall be installed on site to desilt all stormwater or water pumped from excavations.
- B. If additional siltation control is required, check dams or silt fences may be placed in ditches receiving stormwater from areas disturbed by construction.
- C. Siltation/sedimentation pond shall be constructed in accordance with the requirements of the agencies having jurisdiction over facilities to receive discharge from siltation/sedimentation ponds.

### 3.3 FILTER FABRIC FENCES

- A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.
- B. Wire shall be fastened to posts set at 4-foot centers.
- C. Fabric shall be buried into ground approximately 8 inches to prevent silt from washing under fabric.
- D. Fence shall be located to catch silt and prevent discharge to drainage courses.

### 3.4 STRAW BALE FILTER

- A. Installed in drainage way to catch silt.
- B. Dig bales into ground approximately 6 inches and stake in place with 2 wooden stakes in each bale.
- C. Bales to extend above anticipated surface of stream.

### 3.5 PLACING JUTE MATTING

- A. Seed and fertilizer shall be placed prior to placing of matting.
- B. Jute matting shall be unrolled parallel to the flow of water. Where more than 1 strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.
- C. The up-slope end of each strip of matting shall be staked and buried in a 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (1 stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

- D. The Contracting Officer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.
- E. Check-slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as upslope ends. Check-slots must be spaced so that one check-slot or one end occurs within each 50 feet of slope.
- F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.
- G. Matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and check slots shall be fastened at 6-inch intervals cross their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

### 3.6 PLACING CLEAR PLASTIC COVERING

- A. Clear plastic covering shall be installed on erodible embankment slopes as shown in the plans or as designed by the Engineer.
- B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding.
- C. The Contractor shall maintain the cover tightly in place by using sandbags or tires on ropes with a minimum 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams.
- D. The Contractor shall be responsible to immediately repair all damaged areas.

### 3.7 EXISTING DRAINAGE FACILITIES

- A. Should a storm sewer or culvert become blocked or have its capacity restricted due to discharge siltation from Contractor's operations, the Contractor shall clean the facility at no additional expense to the Government.

### 3.8 DRAINAGE DIVERSION

- A. Contractor shall divert the surface runoff water around the site as may be required.
- B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the Drawings.

### 3.9 REMOVAL

- A. After construction is complete but prior to final acceptance, the Contractor shall remove all temporary erosion and sedimentation control measures except plantings and return the existing facilities to their original condition.

END OF SECTION

SECTION 02511

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1994) Steel Welded Wire, Fabric, Plain for Concrete Reinforcement
ASTM A 615/A 615M	(1987; Rev C, 1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616/A 616M	1996) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A 617M	1996) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 31/C 31M	(1995) Making and Curing Concrete Test Specimens in the Field
ASTM C 94.	(1995) Ready-Mixed Concrete
ASTM C 143	(1978; Rev A, 1990) Slump of Hydraulic Cement Concrete
ASTM C 171	(1995) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 173	(1978; Rev A, 1994) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(1982; Rev B, 1991) Air Content of Freshly Mixed Concrete by the Pressure Method

## Fort Lawton Phase Two

ASTM D 1751 (1983; Rev 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; Rev 1992) Preformed Sponge Rubber And Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

### FEDERAL SPECIFICATIONS (FS)

FS SS-S-1401 (Rev. C) Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements

FS TT-S-227 (Rev. E) Sealing Compound: Elastomeric Type, Multi-Component (For Calking, Sealing Component (For Calking, Sealing, and Glazing in Buildings and Othee Structures)

FS TT-S-230 (Rev. C) Sealant Compound: Elastomeric Type, Single Component, Chemically Curing (For Calking, Sealing, and Glazing in Buildings and Other Structures)

FS CCC-C-467 (Rev. C) Cloth, Burlap, Jute (or Kenaf)

### U.S. ARMY CORPS OF ENGINEERS HANDBOOK FOR CEMENT AND CONCRETE (CRD)

CRD-C 300 (1988) Membrane-Forming Compounds for Curing Concrete

## 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300 SUBMITTALS:

Fort Lawton Phase Two  
SD-70, Test Reports

Copies of all test reports for tests specified in paragraphs "CONCRETE" and "FIELD QUALITY CONTROL" shall be submitted within 24 hours of the completion of the test.

SD-76, Certificates of Compliance

Certificates of Compliance shall be submitted for the concrete mix design, curing compound, and joint sealant materials specified under Part 2: PRODUCTS.

SD-91, Records

Copies of certified delivery tickets for all concrete used in the construction shall be submitted.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If it is necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 75 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

## Fort Lawton Phase Two

### 1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 90 degrees F.

## 1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

### 1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control, and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

### 1.4.2 Slip Form Equipment

Slip form paver or curb forming machine will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

## PART 2 PRODUCTS

### 2.1 CONCRETE

Concrete shall conform to the applicable requirements of [Section 03300 CAST IN PLACE CONCRETE except as otherwise specified.] Concrete shall have a minimum compressive strength of 3500 psi at 28 days. The maximum aggregate size shall be 1-1/2 inches.

#### 2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.



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### 2.1.2 Slump

The concrete maximum slump shall be 3 inches where determined in accordance with ASTM C 143.

## 2.2 CONCRETE CURING MATERIALS

### 2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

### 2.2.2 Burlap

Burlap shall conform to FS CCC-C-467.

### 2.2.3 Membrane-Forming Curing Compound

Membrane-forming curing compound shall conform to CRD C 300. Non-pigmented compound shall contain a fugitive dye.

## 2.3 CONCRETE PROTECTION MATERIALS

### 2.3.1 Concrete Protection Materials

Concrete protection materials shall be linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, NAPTHA, or turpetine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals, may be used, except that emulsified mixtures are not acceptable.

## 2.4 JOINT FILLER STRIPS

### 2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

### 2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8-inch thick, unless otherwise indicated.

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### 2.5 JOINT SEALANTS

#### 2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to TT-S-227 or TT-S-230.

#### 2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to FS SS-S-1401.

### 2.6 FORMWORK

Formwork shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

#### 2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

#### 2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more,

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where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

### PART 3 EXECUTION

#### 3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted to conform with applicable requirements of Section 02225, Earthwork for Roads, Railroads and Airfields.

##### 3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

##### 3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

##### 3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

#### 3.2 FORM SETTING AND REINFORCEMENT PLACEMENT

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring

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the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

### 3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope of 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

### 3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

## 3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

### 3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with a vibrator, and the surface shall be finished to grade with a wood float or bull float, edged, and broom finished.

### 3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A

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scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

### 3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

### 3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 0.25 inch.

## 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

### 3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

### 3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

### 3.4.3 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

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### 3.4.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 0.25 inch.

### 3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

#### 3.5.1 Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw.

#### 3.5.2 Expansion Joints

Expansion joints shall be formed with 3/8-inch joint filler strips and spaced a minimum of 50-foot intervals. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Concrete at the joint shall be surface dry and the atmospheric and pavement temperatures shall be above 50 degrees F at the time of

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application of joint-sealing materials. Joints shall be filled with sealer flush with the concrete surface in such manner as to minimize spilling on the walk surface. Spilled sealing material shall be removed immediately and the surface of the walk cleaned.

Expansion joints and the top 1-inch depth of gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned by sandblasting before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

### 3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

#### 3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8-inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

#### 3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 3/8 inch in width shall be provided at intervals not exceeding 50 feet. Expansion joints shall be provided in

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nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.

Expansion joints and the top 1-inch depth of gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

### 3.7 CURING AND PROTECTION

#### 3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

##### 3.7.1.1 Mat Method

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

##### 3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be



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securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

### 3.7.1.3 Membrane Curing Method

A uniform coating of membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the membrane.

### 3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

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### 3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

## 3.8 FIELD QUALITY CONTROL

### 3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing as specified in Section CONTRACTOR QUALITY CONTROL. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

### 3.8.2 Concrete Testing

#### 3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

#### 3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be

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performed on each truckload of material until such time as the air content is within the tolerance specified.

#### 3.8.2.3 Slump Test

Slump tests shall be made in accordance with ASTM C 143. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

#### 3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

#### 3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks and meet surface smoothness requirements.

### 3.9 SURFACE DEFICIENCIES AND CORRECTIONS

#### 3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 0.25 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

#### 3.9.2 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit high or low areas, cracking, discoloration, form marks, tool marks or which are otherwise inconsistent with the overall appearances or show poor workmanship shall be removed and replaced.

END OF SECTION

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## SECTION 02554

### Asphalt Pavement

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	Unit Weight and Voids in Aggregate
ASTM C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 183	Sampling and the Amount of Testing of Hydraulic Cement
ASTM D 75	Sampling Aggregates
ASTM D 140	Sampling Bituminous Materials
ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 977	Emulsified Asphalt
ASTM D 1073	Fine Aggregate for Bituminous Paving Mixtures
ASTM D 2397	Cationic Emulsified Asphalt
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

##### MILITARY STANDARDS (MIL-STD)

MIL-STD 620	Test Methods for Bituminous Paving Materials
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- A. Tests: Copies of test results, within 24 hours after completion of tests.

## 1.2 SAFETY PRECAUTIONS

- A. No smoking, or open flames shall be permitted within 25 feet of heating, distributing, or transferring operations of cutback bituminous materials.

## 1.3 WEATHER LIMITATIONS

- A. Bituminous courses shall be constructed only when the surface is dry. The bituminous course shall not be constructed when the atmospheric or aggregate temperature is below 40 degrees F.

## 1.4 EQUIPMENT, PLANT, AND TOOLS

- A. Equipment, plant, and tools used in the performance of the work shall be maintained in a satisfactory working condition at all times. The Contracting Officer shall have access at all times to the equipment and plant to insure proper operation and compliance with specifications.

- 1. Power Rollers: Power rollers shall be steel-wheel or pneumatic-tired types conforming to the following requirements:

- a. Steel-Wheel: Steel-wheel rollers shall be either tandem or three-wheel type weighing not less than 5 tons, and equipped with adjustable scrapers. The rollers which may be static or vibratory shall be equipped with water tanks and sprinkling apparatus that shall be used when necessary to keep the wheels wet to prevent adherence of the bituminous material to the wheels.
    - b. Pneumatic-Tired: Pneumatic-tired rollers shall be self-propelled and equipped with not less than 9 wheels mounted on 2 axles in such manner that the rear tires will not follow in the tracks of the forward group. The pneumatic-tired rollers shall also be equipped with suitable beams or platforms for ballast loading and shall be loaded to provide required compaction. The tires shall be uniformly inflated to not less than 45 psi.

- B. Mechanical Spreaders: The equipment for spreading, shaping, and finishing shall consist of approved self-contained power machines capable of taking the bituminous mixture directly from the discharge end of traveling plant and spreading the mixture at the required application rate.

- C. Tractors: Tractors shall be of the crawler type and shall be equipped with street plates or flat treads.

- D. Miscellaneous Equipment: Disk, spike-tooth, or spring-tooth harrows, multiple-blade or retread mixers, small tools, and other equipment shall be the required types.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

- A. Aggregates shall consist of a mixture of coarse aggregate, fine aggregate, and mineral filler complying with the requirements specified hereinafter.
1. Coarse Aggregate: Coarse aggregate shall consist of the following:
    - a. Crushed Stone: Crushed stone shall consist of hard durable fragments which are free from soft or disintegrated pieces, vegetable matter, lumps or balls of clay, adherent coatings of clay, and other objectionable matter, and shall have a percentage of wear not exceeding 50 after 500 revolutions, as determined by ASTM C 131.
    - b. Crushed Gravel: Crushed gravel shall consist of clean, tough, durable fragments, free from an excess of flat, elongated, soft, or disintegrated pieces, and free from fragments coated with dirt or other objectionable matter. At least 50 percent by weight of the particles retained on No. 4 sieve shall have two or more fractured faces. The crushed gravel shall have a percentage of wear not exceeding 50 after 500 revolutions, as determined by ASTM C 131.
    - c. Crushed Slag: Crushed slag shall be an air-cooled, blast furnace product having a dry weight of not less than 70 pcf, and shall consist of angular fragments which are reasonably uniform in density, free from dust, and without an excess of thin, elongated pieces, and other objectionable matter. The weight per cubic foot of slag aggregate shall be determined by ASTM C 29. The slag aggregate shall have a percentage of wear not exceeding 50 after 500 revolutions, as determined by ASTM C 131.
  2. Fine Aggregate: Fine aggregate shall conform to ASTM D 1073. Quantity of natural sand shall not exceed 25 percent of the total aggregate. The gradations specified in ASTM D 1073 may be adjusted to meet local materials as directed. That portion of the fine aggregate, including any blended filler, passing a No. 40 sieve shall have a plasticity index not exceeding 6 as determined by ASTM D 4318, a liquid limit not exceeding 25 as determined by ASTM D 4318, and a clay content not to exceed 5 percent after washing and straining.

3. Mineral Filler: Mineral filler shall conform to ASTM D 242.

## 2.2 BITUMINOUS MATERIALS

- A. Bituminous materials shall conform to Grade AR-4000.

## 2.3 COMPOSITION OF MIXTURE

- A. The aggregate for the surface course shall be so graded that the percentage composition by weight, as determined by laboratory tests, will conform to the WSDOT Class B. The percentage of bituminous material by weight of the total mixture to be used for preparing the bituminous mixtures shall be as determined by the Contractor and approved by the Contracting Officer.
  1. Job-Mix Formula: No bituminous mixture shall be produced until a job-mix formula has been prepared by the Contractor and approved by the Contracting Officer. The formula shall indicate the percentage of each sieve-fraction of aggregate and the percentage of bitumen. The job-mix formula shall be allowed tolerances given in TABLE II. No deviation from the approved job-mix formula will be permitted without prior approval.
  2. Gradation Limits for Aggregates: Gradation limits for aggregates in TABLE I are master ranges to govern mixes and represent the maximum and minimum for all cases. The approved formula will provide for a gradation of job aggregates within these master ranges. Deviation from the gradation of the approved formula will be allowed, provided that variations from the formula in any one run do not exceed the tolerances as given in TABLE II.



TABLE I. GRADATION (PERCENT BY WEIGHT PASSING)  
AND RANGE OF BITUMINOUS CONTENT

Sieve Bituminous Mixture	Designation Square-Mesh Sieves	WSDOT Class B
Aggregate	3/4 in.	100
	1/2 in.	90-100
	3/8 in.	75-90
	1/4 in.	55-75
	No. 10	30-42
	No. 40	11-24
	No. 200	3.0-7.0

Bituminous (Percent by Weight of total mixture)

4.5-6.5

NOTE: The range of bituminous material shown represents the normal range of bituminous material contained in the design mix composed of nonabsorptive aggregates after evaporation of the lighter constituents. The upper limit may be raised, when approved, when absorptive aggregates are used.

TABLE II. JOB MIX FORMULA TOLERANCES (PERCENT)

<u>Mineral</u>	<u>Tolerances Plus or Minus</u>
Aggregate passing No. 4 or larger sieve	7
Aggregate passing No. 8, 16, 30, and 50 sieves	5
Aggregate passing No. 100 and 200 sieves	2
Bitumen	0.4

- Quantity of Bituminous Material: The percentage, by weight, of bituminous materials required for each run shall be approved by the Contracting Officer. The percentage of bituminous material will be computed on the basis of laboratory tests of samples of the approved aggregate and bituminous material, and on the field sieve analysis of samples taken from the windrowed blended aggregate for each run. The job-mix formula may be changed to meet specific field conditions without adjustments to contract unit prices.

## 2.4 CRUSHED ROCK BASE COURSE

Crushed Rock Base Course shall be provided in accordance with Section 02225, paragraph 2.1.

## PART 3 EXECUTION

### 3.1 CRUSHED ROCK BASE COURSE

- A. Place and compact base course to 95% of the maximum dry density as determined by ASTM D-1557.

### 3.2 WEARING COURSE

- A. The wearing course placed as an overlay of the existing pavements, shall consist of at least 1-1/2 inches of WSDOT Class B asphalt that is placed and compacted to at least 92% of the theoretical maximum density as determined by ASTM D-2041.
- B. The wearing course placed as new pavement, shall consist of WSDOT Class B asphalt, thickness as shown on the drawings, that is placed and compacted to at least 92% of the theoretical maximum density as determined by ASTM D-2041.

### 3.3 ROLLING FINISHED SURFACE

- A. After all layers have been satisfactorily spread, the surface shall be rolled. Final rolling shall be done by means of power-driven rollers. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the rear wheel of the roller. Alternate trips of the roller shall be of slightly different lengths. The speed of the roller shall be such that lateral displacement of the mixture does not occur. Light blading or floating of the surface with a blade grader during the rolling period may be required. Rolling shall be continued until all roller marks are eliminated, the surface is of uniform texture, and the mixture is compacted to at least 92 percent of maximum density as determined by MIL-STD 620. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but an excess of water will not be permitted. The rollers shall be in good condition, suitable for rolling asphalt, and shall be operated by experienced rollermen. At all places not accessible to the roller, the mixture shall be thoroughly tamped with hand tampers. Should the surface of the surface course for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portions shall be torn up, reworked, relaid, or replaced at no additional cost to the Government. Should any portion of the surface, when laid, become water soaked for any reason, the portion shall be torn up at once, and the mix therefrom

placed in a windrow and aerated until the moisture content is within the limits specified. The mixture shall then be spread, shaped, and rolled as specified.

### 3.4 SHAPING OF EDGES

- A. While the surface is being compacted and finished, the Contractor shall trim the outside edges neatly to line.

### 3.5 GRADE CONTROL

- A. The finished and completed surface course shall conform to the lines, grades, cross section, and dimensions indicated. The lines and grades as indicated shall be maintained by means of line and grade stakes placed by the Contractor in accordance with the SPECIAL CLAUSES.

### 3.6 SURFACE SMOOTHNESS AND THICKNESS TESTING

- A. Tolerances for surface smoothness and thickness shall be as specified in paragraph SAMPLING AND TESTING.

### 3.7 SAMPLING AND TESTING

- A. Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval.
  - 1. Sources of Materials: Source of materials to be used for the wearing course shall be selected in advance of the time required for use in the work. The Contractor shall be responsible for performing tests to determine the suitability of the proposed materials and submitting the test results.
  - 2. Field Testing
    - a. Aggregate and Bitumen Sampling: Sampling of the aggregate and bitumen shall be in accordance with ASTM D 75 for coarse and fine aggregates, ASTM C 183 for mineral filler, and ASTM D 140 for bituminous material. The materials shall be tested for compliance with paragraph AGGREGATES, paragraph BITUMINOUS MATERIALS, and paragraph COMPOSITION OF MIXTURE.
    - b. Asphalt Sampling: Samples of the asphalt mixture shall be obtained for each 400 tons of pavement produced and tested for compliance with paragraph COMPOSITION OF MIXTURE.

- c. Testing: Tests for surface smoothness shall be made in accordance with paragraph Tolerances at intervals of not more than 300 feet along the surface of the finished pavement.
- 3. Tolerance: Suitably sized core samples to determine the thickness of the completed pavement shall be taken at intervals of not more than 500 feet along the surface. The area where samples were removed from the pavement shall be replaced by the Contractor, at no additional expense to the Government.
  - a. Surface-Smoothness Requirements: The surface course shall be tested longitudinally and transversely with a 12-foot straightedge. The straightedge shall be placed parallel to and perpendicular to the centerline at 100 feet intervals along the surface. The finished surface of the surface course shall show no deviation greater than 6.4 mm (1/4 inch) from the 3.66 m (12-foot) straightedge. Surface irregularities in excess of those specified above shall be corrected as directed, without additional cost to the Government.
  - b. Thickness Requirements: The thickness of the pavement shall not vary from that shown by more than 6.4 mm (1/4 inch). A variation in thickness in excess of 6.4 mm (1/4 inch) shall be corrected as directed, without additional cost to the Government.

END OF SECTION

## SECTION 02558

### BITUMINOUS TACK COAT

#### PART 1 GENERAL

##### 1.1 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

#### AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 20 (1970; Rev 1993) Penetration Graded Asphalt Cement

AASHTO M 140 (1988; Rev 1993) Emulsified Asphalt

AASHTO M 208 (1987) Cationic Emulsified Asphalt

AASHTO M 226 (1980; Rev 1993) Viscosity Graded Asphalt Cement

AASHTO T 40 (1978; Rev 1993) Sampling Bituminous Materials

#### AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM D 140 (1993) Sampling Bituminous Materials

ASTM D 946 (1982; Rev 1993) Penetration-Graded Asphalt Cement for Use in Pavement Construction

ASTM D 977 (1991) Emulsified Asphalt

ASTM D 1250 (1980; Rev 1990) Petroleum Measurement Tables

ASTM D 2028 (1976; Rev 1992) Cutback Asphalt (Rapid Curing Type)

ASTM D 2397 (1994) Cationic Emulsified Asphalt

ASTM D 2995 (1993) Determining Application Rate of Bituminous Distributors

ASTM D 3381 (1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction

## 1.2 PLANT, EQUIPMENT, MACHINES AND TOOLS:

### 1.2.1 General Requirements

All plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the results specified.

### 1.2.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gages, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

1.2.3 Power Brooms and Power Blowers: Power brooms and power blowers shall be suitable for cleaning the surfaces to which the tack coat is to be applied.

## 1.3 WEATHER LIMITATIONS

Tack coat shall be applied only when the surface to receive the tack coat is dry. Tack coat shall be applied only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application.

## 1.4 SAMPLING AND TESTING:

### 1.4.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory. No work requiring testing will be permitted until the facilities have been inspected and approved. Copies of all test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.4.2 Sampling: The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40.

### 1.4.3 Initial Sampling and Testing:

#### 1.4.3.1 Bituminous Materials

Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements shall be submitted to the Contracting Officer not less than 30 days before the material is required in the work.

#### 1.4.3.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the tack coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

#### 1.4.3.3 Trial Applications

As a preliminary to providing the complete tack coat, three lengths of at least 25 m for the full width of the distributor bar shall be tacked to evaluate the amount of tack that can be satisfactorily applied. Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 0.15 Liters per square meter. Other trial applications shall be made using various amounts of material as may be deemed necessary.

### 1.4.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL and Section: CONTRACTOR QUALITY CONTROL.

## PART 2 PRODUCTS

### 2.1 BITUMINOUS MATERIAL

Materials shall conform to Aged Residue Viscosity Grade AR 4000 (ASTM D 3381 or AASHTO M226) or Anionic Emulsions RS-1 or SS-1 (ASTM D977 or AASHTO M140), unless otherwise approved by the Contracting Officer.

## PART 3 EXECUTION

### 3.1. PREPARATION OF SURFACE

Immediately before applying the tack coat all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The area to be tacked shall also be dry and clean.

### 3.2 APPLICATION RATE

Bituminous material for the tack coat shall be applied in quantities of not less than 0.15 liters nor more than 0.45 liters per square meter of pavement surface. The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

### 3.3 APPLICATION TEMPERATURE

Normal spray application temperatures are as follows:

Viscosity Grades	
AR 4000	plus 143 degrees C
Emulsions	
RS-1	20-60 degrees C
SS-1	20-70 degrees C

Contractor shall adjust temperatures as necessary to meet local conditions at the time of application.

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 centistokes, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

### 3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the tack coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Following application of the tack material and prior to application of the succeeding layer of pavement, the tack shall be allowed to cure and obtain evaporation of any volatiles or moisture. Until the succeeding layer of pavement is placed, the tacked area shall be maintained by protecting the surface against damage and by repairing and retacking deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material.

### 3.5 FIELD QUALITY CONTROL

Samples of the bituminous material shall be tested for compliance with the applicable specified requirements. A sample shall be obtained and tested by the Contractor for every 1,000 Liters of bituminous material used.



Samples of the bituminous material used will be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample will be retained or tested by the Government.

END OF SECTION



## SECTION 02580

### PAVEMENT MARKINGS

#### PART 1 GENERAL

##### 1.1 REFERENCES

- A. Washington State Standard Specifications for Road, Bridge and Municipal Construction, current edition (WSDOT Standard Specifications).

##### 1.2 GENERAL REQUIREMENTS

This work includes the furnishing and installation of painted, plastic and raised pavement markings upon the roadway and parking lot surfaces in accordance with the Plans at locations shown in the drawings or as directed by the Contracting Officer.

Pavement markings for this Contract are defined as follows:

Edge Stripe - A SOLID WHITE line, 4 inches wide, used on the right edge of the traveled way.

Crosswalk Stripe - A SOLID WHITE line, 12 inches wide, installed parallel to another crosswalk stripe with a minimum of 6 foot space between the lines.

Stop Bar - A SOLID WHITE line, 18 inches wide unless noted otherwise.

Traffic Arrow - A WHITE marking conforming to details L-20 and L-21 in the City of Seattle Standard Plan No. 720a.

Double Yellow - A YELLOW marking formed of a pattern of two rows of yellow Type 1 and Type 2 raised pavement markers (RPM's) with a 4" space between pairs of RPM's. The RPM's shall be spaced longitudinally at three feet, center to center. Type 2 RPM's shall be used in place of every eighth RPM pair.

Double White - A WHITE marking formed of a pattern of two rows of white Type 1 and Type 2 RPM's with pairs of RPM's placed directly adjacent to each other. The RPM's shall be spaced longitudinally at three feet, center to center. Type 2 RPM's shall be used in place of every eighth RPM pair.

Disabled Parking Symbol - A WHITE wheelchair symbol on a blue painted background conforming to WSDOT Standard Plan No. H-5C.

All pavement marking crosswalks, stop lines and arrows, unless otherwise indicated, shall be plastic. All edge stripes and parking lot stall markings shall be paint. All centerline

markings shall be RPM's. Paint and extruded or sprayed plastic material shall be applied with a top dressing of glass beads. Beads shall be applied at the rate of 7 pounds of beads per gallon of paint, and shall be applied at the same time as the paint is applied to the pavement. Beads applied to hot extruded plastic markings while the material is in the semi-liquid state on the roadway. Paint shall comply with the specifications for no heat, instant dry pavement marking. Beads shall comply with the specifications for adherence coated glass spheres. All pavement marking materials shall comply with the requirements of the Washington State Department of Transportation.

### 1.3 SUBMITTALS

Submit four copies of certification from the marking material manufacturer that pavement marking materials and fabrication specifications fully meet the requirements of the Washington State Department of Transportation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

Only pavement marking materials included on the current Washington State Department of Transportation's approved materials list shall be used on this contract.

### 2.2 MATERIALS

- A. RPM's Type 1 shall be white or yellow as shown on the plans, and they shall consist of plastic material only. The markers shall conform to Section 9-21.1 of the "WSDOT Standard Specifications".
- B. RPM's Type 2 shall be Type 2d (yellow-yellow) or Type 2e (white-one side only) and shall conform to Section 9-21.2 of the "WSDOT Standard Specifications".
- C. RPM's Type 1 and Type 2 shall meet the strength requirements of Section 9-21.2 of the "WSDOT Standard Specifications".
- D. Adhesive for RPM's shall be a hot bituminous binder specifically formulated for use with traffic buttons.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Request copies of manufacturers instructions for installing pavement markings to verify that environmental limitations and procedural instructions are followed.

### 3.2 INSTALLATION

- A. Installation instructions for plastic markings shall be provided for both the Contractor and Contracting Officer by the Manufacturer. All materials shall be installed according to the manufacturers recommendations and a manufacturer's technical representative shall be present at the initial material installation to approve the installation procedure.
- B. Application of the raised pavement marker adhesive and installation of the raised pavement markers shall be in conformance with the recommendations of the adhesive manufacturer and the raised pavement marker manufacturer.
- C. Two applications of paint will be required to complete all paint stripe markings. The time period between paint applications is 4 hours minimum, 30 days maximum. The first application of paint shall be applied at a rate to equal 10 mils wet thickness. The second application shall be at a rate equal to 15 mils wet thickness.
- D. Allowable tolerances for painted stripes are as follows:
  - 1. Width of Stripe shall not vary more than plus or minus 1/4 inch.
  - 2. Lane Width, which is defined as the lateral width from the edge of pavement to the center of the lane line, or between the centers of successive lane lines, shall not vary from the widths shown in the drawings by more than plus or minus 4 inches.
  - 3. Film Thickness tolerance not exceeding 10 percent will be allowed for thickness or yield in paint application.

### 3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Verify proper marking type, reflectorization, location, dimension, direction, and materials.
- C. Verify pavement surface is clean and dry prior to application of markings. Direct Contractor to clean pavement as required to provide good marking adherence.

END OF SECTION



## SECTION 02581

### TRAFFIC CONTROL SIGNS

#### PART 1 GENERAL

##### 1.1 REFERENCES

ASTM B 209 alloy 6061 T6 - Sheet Aluminum  
ASTM B 209 alloy 5052-H36 or -H38 - Sheet Aluminum

ASTM B 209 2024-T4	- Aluminum Bolts
ASTM A 307	- Steel Bolts
ASTM B 209 2024-T4	- Aluminum Washers
AASHTO M 183	- Steel Washers
ASTM B 209 6061-T6	- Aluminum Nuts
ASTM A 307	- Steel Nuts
ASTM B 211 2017-T4	- Aluminum Lockwashers
ASTM A 307	- Steel Lockwashers
ASTM A 412, Type 201	- Strap and Mounting Bracket
ASTM A 123	- Steel Galvanizing
ASTM 153	- Steel Bolts and Related Hardware Galvanizing

##### 1.2 GENERAL REQUIREMENTS

This work includes the furnishing and installation of traffic control signs and sign posts.

All permanent signs, unless otherwise indicated, shall be constructed of aluminum sheeting. All signs shall be reflectorized.

All STOP, YIELD, DO NOT ENTER, and WRONG WAY signs shall be constructed of premium enclosed lens or encapsulated lens reflective sheeting.

Standard traffic control signs and guide sign letters, arrows, and symbols shall be in accordance with the "Washington State Sign Fabrication Manual," the FHWA manual "Standard Highway Signs," or both.

##### 1.3 SUBMITTALS

Submit four copies of certification from sign manufacturer that sign materials and fabrication specifications fully meet the requirements of the Washington State Department of Transportation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

All signs shall be fabricated by a manufacturer regularly engaged in the production of traffic control signs.

### 2.2 MATERIALS

Sheet aluminum signs shall be constructed of material conforming to ASTM B 209 alloy 6061 T6, ASTM B 209 alloy 5052-H36 or -H38. Sign panels shall be treated with an Alodine 1200 application prior to applying reflective sheeting.

Sheet thickness shall be as follows:

<u>Maximum Horizontal Dimension</u>	<u>Sheet Thickness</u>
Up to 20 inches	0.063 inch
20 inches to 36 inches inclusive	0.080 inch
Over 36 inches	0.125 inch

The horizontal dimension for a diamond warning sign is considered to be the maximum horizontal dimension.

Bolts shall be fabricated meeting the following requirements: ASTM B 209 2024-T4 - Aluminum, ASTM A 307 - Steel

Washers shall be fabricated meeting the following requirements: ASTM B 209 2024-T4 - Aluminum, AASHTO M 183 - Steel

Nuts shall be fabricated meeting the following requirements: ASTM B 209 6061-T6 - Aluminum, ASTM A 307 - Steel

Lockwashers shall be fabricated meeting the following requirements: ASTM B 211 2017-T4 - Aluminum, ASTM A 307 - Steel

Strap and Mounting Brackets shall be fabricated meeting the following requirements: ASTM A 412, Type 201

Steel Galvanizing shall meet the following requirements: ASTM 153 - Steel Bolts and Related Hardware Galvanizing, ASTM A 123 for all other galvanizing.



Sign posts shall be timber, untreated Western red cedar, treated Douglas fir, or treated Hem-fir. Western red cedar and treated Douglas fir posts shall be Grade No. 2 or better per paragraph 124c WCLIB, paragraph 42.12 WWPA. Treated Hem-fir shall meet paragraph 124a WCLB, paragraph 42.10 WWPA.

## 2.3 MANUFACTURER'S IDENTIFICATION AND DATE

All signs shall show the manufacturer's name and date of manufacture on the back.

## PART 3 EXECUTION

### 3.1 EXAMINATION

All signs shall be inspected at the sign fabricator's plant before shipment to the project. The inspection shall not be made until all materials have been approved. Signs without a "FABRICATION APPROVED" decal will not be permitted on the project.

### 3.2 INSTALLATION

All signs shall be installed in a workmanlike manner. Posts shall be plumb and embedded to a depth of 3'-6". Soil around the sign post shall be well compacted as approved by the Contracting Officer. All signs shall be installed with a mounting height 7' above the adjacent pavement or sidewalk grade.

### 3.3 FIELD QUALITY CONTROL

Field inspection and testing will be performed under provisions of Division 1.

Verify proper sign type, reflectorization, location, direction, post embedment, soil compaction, mounting height, and materials.

END OF SECTION

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## SECTION 02660

### WATER LINES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Furnishing, installing and testing water lines to 5 feet from building lines.
- B. Installation of fire hydrants, valves, and water line appurtenances.

##### 1.2 RELATED SECTIONS

- A. Section 02222 -Excavating, Backfilling and Compaction for Utility Systems
- B. Section 03300 -Cast-in-Place Concrete

##### 1.3 REFERENCES

- A. AWWA C509 - Resilient Seat Gate Valves for Water Supply Service
- B. AWWA C502 - Dry-Barrel Fire Hydrants
- C. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- D. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
- E. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
- F. AWWA C800 - Underground Service Line Valves and Fittings
- G. AWWA C153 - Ductile Iron Compact Fittings 3 in.-24 in. for Water Service
- H. AWWA C150 – Thickness Design of Ductile Iron Pipe

##### 1.4 CONTRACTOR QUALITY CONTROL/VERIFICATION

- A. Testing shall be required prior to final acceptance:
  - 1. Prior to final inspection, all pipelines shall be flushed and cleaned of all debris, disinfected and hydrostatically tested.

2. Any corrections required shall be made at the expense of the Contractor and the line retested.

## 1.5 SUBMITTALS

- A. Submit manufacturer's certificates and catalog cuts for review and approval for products furnished in accordance with Division 1 requirements for shop drawings.

## PART 2 PRODUCTS

### 2.1 PIPE

#### A. Ductile Iron Pipe:

1. Water main pipe shall conform to AWWA C150/C151 and shall be ductile iron thickness Class 50 unless otherwise shown.
2. Joints shall be rubber gasket mechanical joint or push-on joint and shall conform to AWWA C111 (ANSI A21.11).
3. Pipe and fittings shall have a cement mortar lining conforming to AWWA C104 (ANSI A21.4) and be coated with an asphaltic coating.
4. Each length shall be plainly marked with the manufacturer's identification, year cast, class of pipe, and weight. Pacific States pipe, if used, must have been treated for Seattle water and have "SEATTLE" stamped on it.
5. All ductile iron (D.I.) water pipe shall be considered rigid conduit.
6. Restrained joints shall be made up with push-on joint pipe and fittings. The push-on joint restraint device shall be ductile iron with a 350 psi working pressure and shall be U.S. Pipe TR FLEX, Griffin Pipe Products Company SNAP-LOK, Pacific States Lock Joint, or MEGALUG.
7. Alternatively, pipe joints may be restrained using shackle rods and pipe clamps. All shackle rods and associated materials shall be COR-TEN or corrosion resistant equal.

#### B. Copper Tubing:

1. Copper tubing shall conform to the requirements of Type K, annealed. use for connection between plain end pipe of same or different material.

2. The tubing shall be coupled using flare-type compression fittings, conforming to the requirements of AWWA C800, minimum 150 psi working pressure.

## 2.2 DUCTILE IRON FITTINGS

- A. Use for ductile iron pipe.
- B. All fittings shall be short-bodied, compact ductile iron with a minimum rating of 250 psi working pressure conforming to AWWA C153 (ANSI A21.53), except flanged fittings shall conform to AWWA C110 (ANSI A21.10).
- C. Joint shall conform to AWWA C111 (ANSI A21.11).
- D. Dimensions of fittings and design of bell may be modified to conform with the pipe being used.
- E. Cement mortar lining conforming to AWWA C104 (ANSI A21.4).
- F. Gaskets for flat faced or raised faced flanges shall be 1/8-inch thick neoprene having a durometer of 60 plus or minus 5.
- G. Gaskets for flanges having a recess machined to receive an "O" ring shall be neoprene and shall have the dimensions and durometer as recommended for the particular service application by the flange manufacturer.
- H. Provide type, material and identification mark for bolts and nuts.

## 2.3 GATE VALVES

- A. Conform to AWWA C509.
- B. Iron body, bronze stem, resilient wedge.
- C. O-ring stuffing box.
- D. Open counter-clockwise unless otherwise specified.
- E. Non-rising stem type.
- F. Equipped with 2-inch standard operating nut.
- H. Mechanical joint or push-on joint suitable for installation with the type and class of pipe being used or flanged where detailed.

- I All flange faces shall be machined. Flanges shall be drilled to straddle vertical centerline.

## 2.4 STEM EXTENSION

- A. Provide stem extension with standard operating nut and self-centering rockplate support for all valves with operating nut more than 4 feet below grade to raise operating nut to within 36 inches of the ground surface.

## 2.5 VALVE BOXES

- A. Provide for all buried valves.
- B. Valve boxes and tops shall be cast iron 2 piece slip joint type.
- C. Lengths suitable for the particular project or as specified.
- D. Base corresponding to size of valve.
- E. Cover shall have the word "Water" cast on it.

## 2.6 VALVE MARKER POST

- A. Shall have a 4-inch minimum square section and a minimum length of 42 inches, with beveled edges.
- B. Contain at least one No. 3 bar reinforcing steel.
- C. Paint exposed portion of the marker posts with two (2) coats of concrete paint in a color selected by the Contracting Officer.
- D. Stencil the size of the valve and the distance in feet and inches to the valve on the face of the post, using black paint and a stencil which will produce letters 2 inches high.

## 2.7 POST INDICATOR

- A. Post Indicator Valve shall have mechanical joint connections to pipeline and conform to both UL and FM standards for fire protection valves. The valve shall be resilient seated gate valve constructed with ductile iron bodies and bonnets.
- B. Underground valves shall have 2" square ductile iron wrench nut to allow separate operation of the valve even if traffic damage occurs to the connecting indicator post.

Valve stem and upper two O-rings shall be replaceable without having to remove valve bonnet.

- C. The vertical indicator post shall be mounted to the gate valve and set for the corresponding number of turns required to open/shut the valve. The post shall have a wrench that can be locked to the post to prevent unauthorized use.
- D. Length of post shall be determined by the depth of pipeline bury as well as valve diameter.
- E. Post indicators shall be Underwriters Laboratories listed and Factory Mutual Research Corporation approved for use in fire protection systems.

## 2.8 FIRE HYDRANTS

- A. Conform to AWWA C502 except as herein modified.
- B. Main valve opening of the hydrant shall be a minimum of 5-inch diameter.
- C. Provide mechanical or flanged joint outlet with an auxiliary gate valve and valve box. Suitable lugs for anchor rods shall be provided.
- D. One pumper nozzle to match existing pattern, two (2) two and one-half inch (2-1/2") hose nozzles shall be provided.
- E. Provide pentagon operating nuts.
- F. Open by turning counterclockwise.
- G. Depth of clear cover over the pipe shall be three feet (3') unless larger depth or cover is required where the hydrant is installed.
- H. Provide lugs for shackling rods.
- I. Provide sidewalk flange and safety stem coupling which will allow hydrant barrel to separate with minimum damage.
- J. Paint with two coats of paint to match the existing hydrants.
- K. Provide two operating wrenches for fire hydrants.

## 2.9 PIPE BEDDING

- A. Pipe bedding for ductile iron pipe shall be gravel bedding as shown on the drawings. Gravel bedding shall be in accordance with Section 02222, EXCAVATING, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

## 2.10 CONCRETE THRUST BLOCKS

- A. Used for non-structural uses only.
- B. Conform to applicable portions of Section 03300 with the following:

Compression strength and water cement ratio: The minimum compressive strength and cement content of concrete shall be not less than that shown in the tabulation that follows:

Class of Concrete Min. 28-day Compr. Strength <u>(PSI)</u>	Max. Size Aggregate  <u>(Inches)</u>	Min. Cement Pounds  Per Cubic <u>Yd.</u>	Max. W/C  <u>Ratio</u>
3,000	1½	517	0.50

Fly ash may be used at the rate of 100 pounds per cubic yard.

## 2.11 FIRE DEPARTMENT CONNECTION

- A. Fire Department Connection shall be fabricated from 8" nominal diameter steel pipe which has been hot-dipped galvanized. Minimum wall thickness shall be ¼". The FDC shall be equipped with a Siamese fitting threaded for a Seattle standard fitting hose connection and shall be provided with a base and adapter for connection to ductile iron pipe water main.

## PART 3 EXECUTION

### 3.1 EXCAVATION, BACKFILLING AND COMPACTION

- A. Excavation, backfilling and compaction shall be in accordance with Section 02222.



### 3.2 PIPE LAYING

- A. Pipe laying shall be done in accordance with the Specifications and instructions of the manufacturer of the kind of pipe used.
- B. Tools designed especially for installing each particular type and kind of pipe shall be used.
- C. Short Lengths and Field Cut Joints:
  - 1. Short lengths of pipe supplied by the manufacturer shall be used to provide the proper spacing of valves, tees or special fittings.
  - 2. Whenever it becomes necessary to cut a length of pipe, the cut shall be made by abrasive saw or by a special pipe cutter.
  - 3. Pipe ends shall be square with the longitudinal axis of the pipe and shall be reamed and otherwise smoothed so that good connections can be made.
  - 4. Threads shall be cleanly cut.
  - 5. Flaring of copper tubing shall be accurately and smoothly done.
  - 6. All operations for any connections shall be carefully done in accordance with the manufacturer's instructions.
- D. Contamination Prevention:
  - 1. Pipe, fittings, valves and other accessories shall be carefully cleaned of all dirt and foreign material as they are placed.
  - 2. Open ends of pipe and fittings shall be plugged with a temporary watertight plug whenever work is stopped and/or when water in the trench threatens to enter the pipe.
  - 3. Groundwater shall be excluded from the pipe t all times.
  - 4. Particular care shall be exercised to guard against the entrance of sewage into the water line trench during the course of construction. All sewer lines, or other subsurface drains should be located prior to excavation. Adequate provision shall be made for the flow of sewers, drains, and other water courses during construction.

### 3.3 BLOCKING AND BRACING

- A. Blocking and bracing of the pipe and fittings shall be placed so as to secure bearing on undisturbed earth.
- B. Blocking and bracing size shall be as shown in the Standard Detail and shall be of sufficient proportions and installed so as to withstand the required test pressure and operating conditions.
- C. Concrete shall be placed in back of all fittings with unbalanced thrust. Pre-cast blocking shall not be used.
- D. Blocking shall not be covered up without its having been seen by the Contracting Officer.
- E. Blocking shall be formed so that bolts, joints, gaskets, and flanges of adjacent joints are clear of the concrete and so that bolts and joints can be dismantled without removing the concrete.
- F. At tees and crosses where future mains connect, a pre-cast concrete brick may be used between fittings and thrust block.

### 3.4 GATE VALVE INSTALLATION

- A. Valves shall be accurately set at places designated on the drawings.
- B. Inspect each valve for defects.
- C. Adjust stuffing boxes to ensure watertightness without binding the stem.
- D. Set valve and valve box plumb.
- E. Set lower casting of valve box so that it is supported by a styrofoam collar not less than 2 inches in thickness.
- F. Tamp backfill around valve box to a minimum distance of 3 feet on all sides or to face of trench.
- G. Set valve box cover flush with surface.

### 3.5 VALVE MARKER POST

- A. Where required, set valve marker post at edge of right-of-way opposite the valve.

- B. Leave 18 inches of post exposed above grade.

### 3.6 SETTING FIRE HYDRANTS

- A. Hydrants shall be inspected in the field upon arrival to ensure proper working order.
- B. Hydrants shall be installed in accordance with the standard detail.
- C. Hydrants shall not be installed within 3 feet of a traveled roadway.
- D. A minimum 3-foot radius unobstructed working area shall be provided around all hydrants.
- E. Sidewalk flange shall be set 2 inches above finished grade.
- F. Hydrants shall be set on concrete blocks.
- G. Hydrant drain shall waste into a pit of 1-1/4-inch minimum washed rock situated at the base of the hydrant as shown in the detail.
- H. Hydrant laterals under 50 feet long shall consist of a section of 6-inch ductile iron pipe from the main to the hydrant and shall include an auxiliary gate valve set vertically and placed in the line as indicated in the detail.
- I. Hydrant branches over 50 feet long shall consist of a section of 8 inch ductile iron pipe and include required reducer to connect to hydrant.
- J. Hydrants shall be restrained as shown in the detail. Shackle rods shall be cleaned and painted after installation with 2 coats of asphalt varnish, or with such other bituminous paint as may be approved by the Contracting Officer.
- K. The exposed portion of the hydrant shall be painted with one field coat. The type and color of the paint will be designated by the Contracting Officer.
- L. Any new or existing hydrant not in service shall be identified by covering with a burlap or plastic bag.
- M. Install guard posts only where specifically directed by the Contracting Officer.

### 3.7 HYDRANT BARREL EXTENSIONS

- A. Provide where required due to placement of main at greater than normal depth or for adjustment to surface grade.

### 3.8 FIRE DEPARTMENT CONNECTION

- A. Set plumb as shown on drawings. Install in accordance with manufacturer's recommendations.

### 3.9 HYDROSTATIC PRESSURE TEST

- A. Water mains and appurtenances shall be tested in sections of convenient length under a hydrostatic pressure equal to 125 psi in excess of that under which they will operate.
- B. The pumps, gauges, plugs, saddles, corporations, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.
- C. Pipeline shall be backfilled sufficiently to prevent movement of pipe under pressure.
- D. Thrust blocks shall be in place and time allowed for the concrete to cure before testing.
- E. Procedure:
  - 1. The mains shall be filled with water and all air removed prior to starting the test.
  - 2. The test shall be accomplished by pumping the main up to the required pressure; stop the pump for fifteen (15) minutes, then pump the main up to the test pressure again.
  - 3. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter with a sweep unit hand registering 1 gallon per revolution. The meter to be approved by the Contracting Officer.
  - 4. Acceptability of the test will be determined by two factors:
    - a. The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{ND(P)}{7,400}^{0.5}$$

in which

L = Allowable leakage, gallons/hour

N = No. of joints in the length of  
pipeline tested

D = Nominal diameter of the pipe in  
inches

P = Average test pressure during the  
leakage test, psig

- b. There shall not be an appreciable or abrupt loss in pressure during the fifteen (15) minute test period.
  - 5. Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the Contracting Officer.
  - F. All tests shall be made with the hydrant gate valves open and pressure against the hydrant valve. After the test has been completed, each gate valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the gate valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked.
  - G. Sections to be tested shall normally be limited to 1,500 feet.
  - H. Prior to requesting the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to assure himself that the pipe is in a satisfactory condition.
- 3.10 PAINTING
- A. Paint fire hydrant, FDC, and existing hydrants prior to final project acceptance as indicated on standard details.
- 3.11 DISINFECTION OF MAINS
- A. Main sterilization shall be accomplished by either of the following two methods at the Contractor's option. No other method of sterilization will be accepted unless, prior to use, the Contractor obtains written approval from the Contracting Officer.

B. Method No. 1:

1. A chlorine gas-water mixture, or dry chlorine gas may be applied by means of a chlorinator, or the gas may be fed directly from a chlorine cylinder equipped with the proper devices for regulating the flow, and the effective diffusion of gas within the pipe. Use of the chlorinator is preferred to direct feed from the cylinder.
2. The preferable point of application for the chlorinating agent is at the beginning of the pipeline extension, or any valved section thereof, and through a corporation cock inserted in the horizontal axis of the pipe. The water injector for delivering the gas-water mixture into the pipe may be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. In a new system, application may be at the pumping station, elevated tank, standpipe, or reservoir.
3. Water from the existing distribution system, or other source of supply, shall be controlled to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine gas-water mixture or dry gas feed shall be in such proportion that the rate of water entering the newly laid pipe will be at least 50 parts per million. A color compactor set will be used to determine chlorine residual.
4. Back pressure, causing a reversal of flow in the pipe being treated, shall be prevented.
5. Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least ten (10) parts per million.
6. In the process of chlorinating newly laid water pipe, all valve or other appurtenances shall be operated while the pipeline is filled with the chlorination agent.
7. Following chlorinating, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity, until the replacement water throughout its length, upon test, shows the absence of chlorine or in the event chlorine is normally used in the source of supply, until the tests that show a residual not in excess of that carried by the system.
8. Should the initial treatment prove ineffective, the chlorination procedures shall be repeated until tests shown that the water sample from the newly laid pipe conforms to the requirements of this section.

C. Method No. 2:

1. A mixture of either calcium or sodium hypochlorite or chlorinated lime of known chlorine content and water may be substituted as an alternative for liquid chlorine. (Typical commercial products of this type are HTH, Perchloron, Clor, Purex, etc.).
2. Prepare a solution containing approximately 5% available chlorine by weight, in the case of HTH or Perchloron, at 70% available chlorine, use 6 pounds per 10 gallons of water. In the case of clor, at 15% available chlorine, add 2 parts of water to 1 part of Clor. For other strength compounds, adjust dilutions accordingly.
3. To prepare the chlorine compound-water mixture, first make a paste, and then thin to a slurry, to ensure getting all active ingredients into solution The prepared solution shall be injected by means of a hypochlorinator, or hand or engine operated pump. Pumping into the newly laid pipe shall follow the conditions outlined under Method No. 1 for chlorine applications.
4. Provisions for final flushing and bacteriological testing under this alternative should be the same as those described in Method No. 1 above.

- D. Before placing the lines in service, a satisfactory report of approval shall be received from the local or state health department on samples collected from representative points in the new system. Sterilized sample bottles and/or instructions shall be obtained by the Contractor from the laboratory where the samples will be tested.
- E. The Contractor shall collect all samples for the bacteriological test under direct supervision of the Contracting Officer. All costs associated with bacteriological testing including the cost of any re-testing will be borne by the Contractor.
- F. Should the disinfectant treatment result in an unsatisfactory test, the procedure shall be repeated until satisfactory results are obtained.
- G. Discharge of hypochlorinated water to surface waters is strictly prohibited. The environment to which the chlorinated water is to be discharged shall be inspected and if there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to be wasted to neutralize the chlorine residual remaining in the water. Disposal may be made to any available sanitary sewer provided the rate of disposal does not overload the sewer and the disposal is approved by the sewer agency having jurisdiction. the sewer agency shall be given 48 hours advance notice of such disposal. Where necessary, federal, state, and

local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

### 3.12 FLUSHING THE MAINS

- A. Upon completion of pipe laying, chlorination and pressure testing, all dirt and foreign matter shall be removed by a thorough flushing through all hydrants, blowoffs or other approved means. Each section of newly laid pipe between valves or dead ends shall be flushed independently, and fire hydrants or other dead end appurtenances shall be flushed simultaneously with the parent line.
- B. The Contractor shall be responsible for rescheduling and organizing his work so as to use flushing water only during off-peak hours and in the most economical manner.
- C. No flushing shall be performed without the prior approval of the Contracting Officer.

### 3.13 PLACING IN OPERATION

- A. Upon completion of the work and before its final acceptance, the entire system shall be put in operation under normal pressure and operated at that pressure for a period of not less than ten (10) days by the Contractor.
- B. Any leaks or defects in the construction of the system that may develop shall be repaired and the test continued until the system is practically watertight.
- C. No provision of this Section shall be construed as waiving any provision of the Contractor's guarantee.

END OF SECTION



## SECTION 02711

### FOUNDATION DRAINAGE SYSTEM

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Foundation drains for buildings and walls.
- B. Perforated pipe for roof drainage collection systems.

##### 1.2 RELATED SECTIONS

- A. Section 02221 - Excavation, Filling and Backfilling for Buildings.
- B. Section 02222 - Excavation, Trenching and Backfilling for Utility Systems.
- C. Section 02720 - Storm Drainage System

##### 1.3 REFERENCES

- A. AASHTO M 252 - Corrugated Polyethylene Drainage Tubing
- B. ASTM F 405 – Corrugated polyethylene (PE) Tubing and Fittings

##### 1.4 SUBMITTALS

- A. Certifications from the manufacturers attesting that materials meet specification requirements.

##### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Materials placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Plastic pipe shall not be exposed to direct sunlight for more than 6 months from time of manufacturer to installation.

## PART 2 PRODUCTS

### 2.1 PERFORATED DRAIN PIPE

- A. Corrugated Polyethylene (PE) Drainage Pipe:  
AASHTO M 252 (3 to 10 inches)
- B. Perforated drain pipe shall be a flexible high density polyethylene pipe corrugated on the inside and outside. Nominal pipe diameter shall be as shown on the drawings.

### 2.2 PERFORATION AND SLOT SIZE

- A. Slots: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 1/8 inch or be less than 1/32 inch. The length of individual slots shall not exceed 1-1/4 inches on 3 inch diameter tubing; 10 percent of the tubing inside nominal circumference on 4 to 8 inch diameter tubing; and 2-1/2 inches on 10 inch diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in the quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe. The water inlet area shall be a minimum of 0.5 square inch per linear foot of tubing. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

### 2.3 FITTINGS

- A. Fittings shall be of compatible materials for pipe, of corresponding weight and quality, and as specified herein. Fittings shall be supplied by the pipe manufacturer to ensure tight and uniform connection of component parts.

### 2.4 BEDDING AND PERVIOUS BACKFILL FOR FOUNDATION DRAINS

- A. Bedding shall be in accordance with Section 02222, EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS.

### 2.5 PIPE COVER AND WRAPPING MATERIALS

- A. Where shown on the drawings, pipe shall be wrapped with a non-woven filter fabric weighting at least 4 oz./yd.<sup>2</sup>. Water flow rate shall be 285 gal./min./SF and grab tensile strength of at least 120 lb.

## 2.6 PREFABRICATED DRAINAGE COMPOSITE

- A. A prefabricated drainage composite shall be used against all exterior surfaces of the foundation and against all retaining wall surfaces in contact with earth. The composite shall have a core compressive strength no less than 15,000 pounds per square foot (psf). It shall accommodate a minimum flow of 15 gallons per minute per unit with and shall have a core thickness no less than 0.38 inches. The composite shall be equipped with a thin, high-strength polymeric film on the flat side to prevent water from penetrating the foundation or retaining wall should a crack develop during the lifetime of the structure.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Trenching and excavation shall be in accordance with Section 02222, EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES or Section 02221, EXCAVATION, TRENCHING AND BACKFILLING FOR BUILDINGS as applicable.
- B. Prefabricated drainage composite shall be placed between the backfill and the surface contacting the earth with the polymeric film surface in contact with the surface to be drained. Panels shall overlap by a minimum width of two inches (2"). The panel may be held in place by concrete nails, mastic, double-sided tape, or other mechanical means. The filter fabric shall overlap the top of the panel and the base where the drain pipe is located.
- C. Bedding: Pipe bedding shall be placed as shown on the drawings and compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.
- D. Pipe Laying: Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Interior of pipe shall be cleaned thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Perforated pipe shall be laid with perforations facing down. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated corrugated polyethylene drainage tubing and plastic piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.

E. Jointing:

1. Corrugated polyethylene (PE) pipe joints shall be in accordance with ASTM F 405.

F. Backfilling: After joints and connections have been inspected and approved, the specified backfill material shall be placed on each side of the pipe. When placing the backfill, care shall be taken to prevent displacement of or injury to the pipe. A protective covering, as specified, shall be placed over the pervious backfill for the full width of the trench before regular backfill is placed. Backfill shall be compacted as specified in Section 02221, EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS or Section 02222, EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS, as applicable.

END OF SECTION

SECTION 02720  
STORM DRAINAGE SYSTEM

PART 1        GENERAL

1.1        SECTION INCLUDES

- A.        Storm drain and roof drain systems.

1.2        RELATED SECTIONS

- A.        Section 02222 -Excavation, Trenching and Backfilling for Utilities Systems
- B.        Section 02275 - Temporary Erosion Control
- C.        Section 02730 - Sanitary Sewers

1.3        REFERENCES

- A.        ASTM C 478 - Precast Reinforced Concrete Manhole Sections
- B.        ASTM D 3212 - Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
- C.        ASTM D 2321 -Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
- D.        AWPB LP-22: Waterborne salt preserve ground contact application
- E.        AASHTO M-252: Corrugated Polyethylene Drainage Tubing
- F.        ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

1.4        SUBMITTALS

- A.        Certificates of Compliance: Certified copies of test reports demonstrating conformance to applicable pipe specifications shall be delivered to the Contracting Officer before pipe is installed.
- B.        Installation Procedures: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material

being installed, printed copies of these recommendations shall be furnished to the Contracting Officer prior to installation.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.
- B. Handling: Materials shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

## PART 2 PRODUCTS

### 2.1 PIPE FOR STORM DRAINS

- A. Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements for the following pertinent types:
  - 1. Polyvinyl Chloride (PVC) Pipe: Conform to ASTM D3034, Type PSM, SDR-35.
  - 2. Corrugated Polyethylene (PE) Pipe: Conform to AASHTO M252.

### 2.2 CATCH BASINS

- A. Construction shall be precast reinforced concrete, complete with frames and covers or gratings and with fixed galvanized steel ladders where indicated.
- B. Catch basins including frames, grates and lids shall conform to the Standard Details. Catch basins shall be constructed in accordance with ASTM C478.

### 2.3 JOINTS

- A. For PVC Pipe: Joints shall be in accordance with the requirements of ASTM D 3212.
- B. For Corrugated Polyethylene Pipe: Use couplings and fittings recommended by the pipe manufacturer.

## 2.4 HYDROSTATIC TEST ON WATERTIGHT JOINTS

- A. A hydrostatic test shall be made on the water tight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Test requirements for joints in PVC pipe shall conform to ASTM D 3212.

## 2.5 WASHED ROCK

- A. Washed rock shall be durable, clean round stone nominally one inch in diameter with no more than .5% passing the No. 200 sieve.

## 2.6 TRENCH DAMS

- A. Trench dams shall be of Class B asphalt, cooled sufficiently so as not to damage the pipe or trench liner.

## 2.7 TRENCH LINER

- A. Material shall be HDPE or PVC with a minimum thickness of 30 mils in accordance with ASTM D1593. Material shall have a minimum hydrostatic resistance of 150 lb/in<sup>2</sup> in accordance with ASTM D751 and a minimum tear strength of 20 lbs. in accordance with ASTM D104.
- B. Liner shall be formulated to resist the detrimental effects of ozone and sunlight.
- C. Joints shall be as recommended by the manufacturer to form a continuous watertight lining system.

## 2.8 LUMBER

- A. Lumber shall consist of incised, pressure treated western species soft woods, sized according to drawings and treated for ground contact in accordance with AWPB LP-22.

## 2.9 TRENCH DRAIN AND GRATE

- A. Trench drain shall be a pre-manufactured modular drain system of channel sections with a built-in slope. Channel sections shall be formed of fiberglass or polymer concrete for embedment as shown on the drawings. Channels shall have inter-locking

joints and horizontal ribs to ensure a positive anchor in the encasement concrete. Concrete shall conform to Section 3300 cast-in-place concrete.

- B. Grates shall be of ductile iron for load Class E, extra heavy duty, solid tire fork lifts or slotted galvanized steel for load Class B, medium duty as shown on the drawings. Grates shall be components of the trench drain system as furnished by the trench drain manufacturer. Grates shall be provided with the manufacturer's standard locking devices to secure the grate to the top of the channel.

#### 2.10 PERFORATED DRAIN PIPE

See 2.1/2.2 under Section 02711, FOUNDATION DRAINAGE SYSTEM.

#### 2.11 PIPE COVER AND WRAPPING MATERIALS

See 2.5 under Section 02711, FOUNDATION DRAINAGE SYSTEM.

#### 2.12 FASTENERS

- A. Expansion anchor bolts shall be minimum of 3/8" in diameter. Bolts, nuts, and washers shall be made of stainless steel.
- B. Carriage bolts, nuts and washers shall be galvanized for corrosion resistance. Carriage bolts shall be a minimum of 3/8" in diameter and be of sufficient length to penetrate both 2"x8" planks and the 2' 2"x4" stake.

### PART 3 EXECUTION

#### 3.1 EXCAVATION, TRENCHING AND BACKFILLING

- A. Excavation of trenches and for appurtenances and backfilling for storm drains shall be in accordance with the applicable portions of Section 0222, Excavation, Trenching and Backfilling for Utilities Systems.

#### 3.2 BEDDING

- A. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. Bedding for PVC pipe and corrugated PE pipe shall meet the requirements of ASTM D2321.



### 3.3 PLACING PIPE

- A. Each pipe shall be carefully examined before being laid and defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling and those pipes damaged during placement shall be removed and replaced.
- B. PVC Pipe: Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.
- C. Corrugated Polyethylene (PE) Pipe: Laying shall be with the separate sections joined firmly and shall follow manufacturer's recommendations.

### 3.4 MOVEMENT OF CONSTRUCTION MACHINERY

- A. In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced.

### 3.5 CATCH BASINS

- A. Construction details for catch basins and inlets shall follow all applicable provisions for construction of sanitary sewer manholes, Section 02730.
- B. Backfill around catch basins shall be placed around the catch basins and compacted in successive layers six (6) inches in thickness and up to six (6) inches over the crown of the highest pipe connected to the catch basin.
- C. The inlet frame may be either cast into a concrete collar or set flange down on concrete adjustment blocks and mortared.
- D. Inlet frame shall not be grouted to final grade until the final elevation of the pavement, gutter, ditch or sidewalk in which it is to be placed has been established.
- E. Location of catch basins shall be staked by the Contractor and reviewed by the Contracting Officer prior to installation.

- F. All openings in the walls of catch basins constructed with precast sections for the insertion of pipe connections and outlet trap castings shall, after pipe or castings have been placed to their final position, be grouted tightly in place to present an inside and outside surface conforming to the Standard Details.
- G. The spigot end of the pipe shall be cut square with the last point of contact with the inside wall surface.
- H. Overflows and tees shall be placed true to the elevations shown and set level.

### 3.6 FASTENER INSTALLATION

- A. Expansion bolt holes shall be predrilled at approximately half the thickness of the concrete slab to prevent cracking and pullout. Expansion anchor bolts shall be installed according to manufacturer's recommendations.
- B. Carriage bolts shall be installed according to manufacturer's recommendations.

### 3.7 TRENCH DRAIN AND GRATE

- A. Install trench drain and grate in accordance with manufacturer's recommendations.
- B. Securely restrain trench drain sections while placing concrete.

END OF SECTION

SECTION 02730  
SANITARY SEWERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sanitary Sewer and Appurtenance construction.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavation, Trenching and Backfilling for Utilities.

1.3 REFERENCES

- A. ASTM D3034 - Type PSM Poly (Vinyl Chloride)(PVC) Sewer Pipe and Fittings
- B. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
- C. ASTM C150 - Portland Cement

1.4 SUBMITTALS

- A. Manufacturer's certificates and catalog cuts for review and approval for materials specified in accordance with Division 1, Submittals.

1.5 QUALITY ASSURANCE

- A. Before sewer line are accepted, all lines shall be tested as specified herein and inspected for line and grade by checking each section between manholes for alignment. a full circle of light shall be seen by looking through the pipe at a light held in the manhole at the opposite end of the section of sewer line being inspected.
- B. All lines shall be tested for leakage.
- C. Conduct deflection test and perform TV inspection.
- D. Any corrections required shall be made at the expense of the Contractor and the line retested.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials to prevent damage in accordance with the manufacturer's recommendations.

## 1.7 PROTECTION OF LIVE SEWERS

- A. All existing live sewers shall remain in service at all times. Adequate provision shall be made for disposal of existing sewerage flow if any existing sewers are damaged.
- B. Any damage to the existing system shall be repaired to a condition equal to or better than that existing prior to the damage at no cost to the Government.
- C. The existing system is discharged through some sewers with flat grades. All water, accumulating during construction, shall be removed from the new sewers and shall not be permitted to enter system. The Contractor will be required to flush out the existing lines if gravel, rocks or other debris are permitted to enter the existing lines.
- D. The physical connection to an exiting manhole or sewer line shall not be made until so authorized by the Contracting Officer. This authorization will not be given until all upstream lines have been completely cleaned, all debris removed, and where applicable, a pipe temporarily placed in the existing channel and sealed.

## 1.8 USE OF SEWERS PRIOR TO COMPLETION

- A. The Government hereby reserves the right to make use of any portion of the work prior to completion of the entire Contract without invalidating the Contract and without constituting acceptance of any of the work.

## PART 2 PRODUCTS

### 2.1 BEDDING MATERIALS

- A. Bedding materials shall be gravel bedding in accordance with Section 02222.

### 2.2 MANHOLE PIPE ENTRY COUPLINGS

- A. Manhole entry coupling for PVC pipe connections to manholes shall provide a watertight joint and utilize a rubber ring to seal against the pipe. The coupling's exterior surface shall be sand impregnated epoxy or similar rough surface to insure adhesion with the mortar.

- B. Resilient connectors conforming to ASTM C923 may be used at the Contractor's option. Such connectors shall not be cast-in-place in precast structures.

## 2.3 MANHOLE COLLAR

- A. Manhole collar shall be constructed of concrete with 3,000 psi concrete prepared from ASTM C150 Type I or II Portland cement or of cold mix asphaltic concrete.
- B. Collar shall extend vertically from grade (top of cover elevation) to bottom of highest adjustment ring. Collar shall extend a minimum of 12 inches measured radially beyond the manhole cover frame.

## 2.4 PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) Sewer Pipe
  - 1. Conform to ASTM D3034, SDR 35, or ASTM F789.
  - 2. Joints shall conform to ASTM D3212 using a restrained rubber gasket conforming to ASTM F477.
  - 3. Fittings shall be injection molded tees or factory solvent welded saddle tees. Saddles fastened to pipe with external bands are not acceptable on any new system, unless specifically approved by the Contracting Officer.
  - 4. All PVC sewer pipe shall be considered flexible conduit.

# PART 3 EXECUTION

## 3.1 SURVEY LINE AND GRADE

- A. The Contractor shall constantly check line and grade of the pipe and, in the event they do not meet specified limits, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

## 3.2 EXCAVATION, TRENCHING AND BACKFILLING

- A. Excavation, trenching and backfilling shall be accomplished in accordance with Section 02222.

### 3.3 BEDDING

- A. Proper preparation of foundation, and placement of bedding material shall precede the installation of all sewer pipe. This shall include the necessary preparation of the native trench bottom as well as placement and compaction of required bedding material to a uniform grade. Backfill material around the pipe will be placed in a manner to meet requirements specified herein.
- B. The pipe bedding shall be placed so that the entire length of the pipe will have full bearing on the bedding. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug to assure uniform support along the pipe barrel.

### 3.4 PIPE LAYING

- A. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the bedding has been prepared.
- B. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surfaces.
- C. Pipe laid shall be retained in position by mechanical means or otherwise, as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place.
- D. Variance from established line and grade shall not be greater than  $\frac{1}{32}$  of an inch per inch of pipe diameter, not to exceed  $\frac{1}{2}$  inch provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed  $\frac{1}{64}$  inch per inch of pipe diameter,  $\frac{1}{2}$  inch maximum.
- E. The sewer pipe shall be laid upgrade from point of connection on the existing sewer or from a designated starting point. The sewer pipe shall be installed with the bell end forward or upgrade.
- F. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a temporary plug.
- G. As the pipe is installed, it shall be backfilled with the specified bedding material up to an elevation 6 inches above the pipe crown, taking care that the backfill is in contact with the entire periphery of the pipe. The backfill shall be so carefully placed and firmly

compacted that the subsequent backfilling operations will not disturb the pipe in any way.

### 3.5 PIPE JOINTING

- A. All extensions, additions and revisions of the sewer system, unless otherwise specified, shall be made with sewer pipe jointed by means of a flexible gasket which shall be fabricated and installed in accordance with these Specifications.
  - B. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position, or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed and replaced, cleaned and relubricated if required before the jointing is attempted.
  - C. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.
  - D. Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted.
  - E. At the end of the work day, the last pipe laid shall be blocked to prevent creep during "down time".
- D. Channels
- 1. Constructed in field.
  - 2. Conform accurately to the sewer grade and bring together smoothly with well rounded junctions.
  - 3. Channel sides shall be carried up vertically to the crown elevation of the various pipes.
  - 4. Shelf between channels shall be constructed with concrete and smoothly finished and warped evenly with slopes to drain.

E. Manhole Cover

1. Final elevation and tilt of cover shall conform to the restored street surface unless otherwise specified.
2. Warping of surfacing to meet grade of castings will not be allowed.
3. Provide not less than 4 inches or more than 16 inches of grade rings between the top of the cone or slab and the underside of the manhole casting ring for adjustment of the casting ring to street grade or ground surface.
4. Both inside and outside of the grade rings shall have a smooth uniform mortar finish to ensure a watertight seal.

F. Backfill

1. Extend around manhole and at least one pipe length into each trench.
2. Hand place and tamp selected native material up to an elevation of six inches above the crown of all entering pipes.

F. Manhole Collar

1. Contractor shall install either a concrete or asphalt collar of sufficient size around the neck and frame to hold assembly in place in traffic areas.

3.6 CONNECTIONS TO EXISTING MANHOLES

- A. The Contractor shall verify the existing manhole invert elevations prior to construction.
- B. Excavate completely around the existing manhole to ensure against unbalanced loading on the manhole.
- C. Keep the manhole in operation at all times and take precautions necessary to prevent any debris or other materials from entering the sewer.
- D. Contractor may be required to install a tight pipeline bypass through the existing channel. If the connection is to a dead end manhole, the outlet shall be plugged watertight with a metal mechanical screw type plug. Plug shall be secured to the ladder with a rope or chain.
- E. Bring laterals into the existing manhole so that the crowns of the two incoming pipes are at the same elevation unless otherwise specified.



- F. Reshape the existing base to provide a channel equivalent to that specified for a new manhole.
- G. The Contractor shall be responsible for repairing all damage to the manholes resulting from his operations.

### 3.7 REPAIRS

- A. Any pipe or appurtenance which has been laid or jointed that is not in conformance with the Specifications shall be repaired or be removed and replaced at the expense of the Contractor.
- B. Any concrete manhole with any continuous crack having a surface width of 0.01 inch or more extending for a length of 12 inches or more regardless of position in the wall shall be removed and replaced.
- C. Repair bands or clamps or concrete collars shall not be used to repair defective pipe.

END OF SECTION

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SECTION 02811  
IRRIGATION SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Pipe and fittings.
- B. Sprinkler heads, valves, quick couplers.
- C. Controller, backflow preventer assembly and connections to power and water supply (meter by others).
- D. Trenching, installation of system and connection to valves, testing, backfilling and all adjustments required for a fully functioning total system.

1.2 COORDINATION

Coordinate work with other utilities.

1.3 REFERENCES

- A. ANSI/AST, D2564 - Solvent cements for Poly Vinyl Chloride plastic pipe and fittings.
- B. ASTM D2241 - Poly Vinyl Chloride plastic pipe (SDR-PR).
- C. APWA Standard Specifications, Section 49-2.11, Sprinkler System.

1.4 SYSTEM DESCRIPTION

Electrical solenoid controlled underground sprinkler system of PVC plastic pipe and fittings, with pop-up heads in one completely automatic system in accordance with the drawings and specifications, complete and ready for use. The work shall consist of furnishing all materials necessary for a complete installation including backflow preventer and vault, assembly, pipe, automatic and manual valves, fittings, sprinklers, electrical controls, electrical wiring and all appurtenances related thereto. Included shall be all labor of installation, including trenching, plumbing, backfilling, electrical, plumbing and electrical adjustments, and all other items of labor necessary for a satisfactory operating system. System layout shall provide total irrigation coverage of landscape planted areas throughout entire work area.

## 1.5 SUBMITTALS

- A. Record Drawings of encountered existing wiring, utilities, piping as well as the new sprinkler system showing location and depth of all water lines, sprinkler heads, pipe sleeves, drains and all valves at completion of work shall be provided by the Contractor including one full size set and two additional sets reduced to 1/2 size and enclosed in waterproof package and stored with the controller.

## 1.6 INTERPRETATION OF DRAWINGS

- A. Irrigation plan is diagrammatic and is not intended to show exact locations of piping, valves or controllers. Refer to plans of other trades for coordination.
- B. Locate these items in planting areas as closely as possible to related curbs, header boards, fences or edges of paving. Verify with the Contracting Officer visible (above ground) locations of such items as controller, backflow preventor and valve boxes
- C. Pipe main and lateral lines and wiring shown parallel on drawing may be placed in a common trench.
- D. Sprinkler heads are shown accurately and shall be installed as indicated by center of symbol, location subject to staking by contractor and review by The Contracting Officer.
- E. Trenching potentially disturbing other utilities or root systems of existing trees to be brought to the attention of the Contracting Officer before proceeding.

## 1.7 EXTRA STOCK

- A. Provide the following extra items:
  - 1. Five sprinkler heads of each type and size and five nozzles for each specified.
  - 2. Four quick coupler keys and swivels for quick couplers.
  - 3. Two quick coupler cover keys.
  - 4. Two irrigation head adjusting keys per manufacture head type.

## 1.8 STANDARDS AND QUALIFICATIONS

- A. Contractor must be a state licensed landscape irrigation contractor. The irrigation system must be installed by a journeyman irrigation mechanic or journeyman plumber. Valve

wiring of 24 volts shall be installed per local code requirements by the irrigation contractor or electrical contractor.

#### 1.9 SCHEDULING OF WORK

With Locators, Inc. and Contracting Officer all known utilities and wiring before proceeding.

#### 1.10 PROTECTION

- A. Contractor responsible for any damage to any work covered by these specifications before Final Acceptance of his work.
- B. Securely cover all openings into systems and cover all apparatus, equipment, and appliances, both before and after being set in place to prevent obstructions in pipes and breakage, misuse, or disfigurement of apparatus, equipment or appliance.
- C. Workmanship first class, efficient and to best ability. Intent of this specification is to give Owner a good and complete installation.

#### 1.11 VERIFICATION OF DIMENSIONS

- A. Before proceeding with any work, carefully check and verify all dimensions; report any variation to the Contracting Officer.
- B. After installation and before proceeding with any work, test static PSI and inform the Contracting Officer of results.

#### 1.12 WARRANTY

- A. Irrigation is part of the one year warranty required by the Contract Documents; the entire irrigation system shall be guaranteed by the Contractor to give complete and satisfactory service as to material and workmanship for a period of one year from day of Final Acceptance of the work. Should any trouble develop within one year, which, in the opinion of the Contracting Officer, is due to inferior or faulty material and/or workmanship, the trouble shall be corrected, without delay, to the satisfaction of the Government and at the Contractor's expense. Any settling of backfilled trenches shall be repaired by the Contractor at his expense, including restoration of planted or paved areas.

#### 1.13 INSTRUCTIONS TO OWNER

Contractor shall instruct the Government's maintenance personnel in operation and care of the equipment and systems and shall provide data covering all system components.

Operation manuals, pamphlets and written instructions shall be bound in a 3-ring binder. Contractor shall provide two (2) sets to the Contracting Officer at time of final walk-through for completion.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers shall be as specified.
- B. Any substitution of products shall be reviewed by the Contracting Officer after review of product specifications provided by the contractor. It shall be the Contracting Officer's sole determination as to the acceptability of substitutions.

### 2.2 PIPE MATERIALS

#### A. PIPE:

1. Copper pipe and fittings shall be in accordance with Section 02660.
2. Poly Vinyl Chloride pipe shall be in accordance to ASTM-D-2241 and shall be National Sanitation Foundation (NSF) approved. All supplied PVC pipe and fittings shall be homogenous throughout and free from visual or physical defects. All materials shall be new and of domestic manufacture. PVC pipe shall be non-toxic, free from taste and odor and self-extinguishing. All PVC pipe shall be continuously and permanently marked with the following information: Manufacturer's name, kind of pipe, pipe size, National Sanitation Foundation (NSF) approval and schedule number or class designation. Irrigation mainlines are to be Schedule 40, and lateral piping shall class 200 PVC pipe.
3. Sleeves and conduit for all irrigation water lines and wiring under pavement shall be Schedule 40 PVC, sized to allow for easy installation of piping and wiring within the sleeving.

B. Fittings: Type and style of connection to match pipe.

C. Solvent Cement: ANSI/ASTM D2564 for PVC pipe and fittings.

### 2.3 SPRINKLER HEADS:

- A. Provide heads according to the degree of arc and other features as specified in the irrigation legend and shown on plans.

## 2.4 AUTOMATIC VALVES

- A. Automatic control valves: Provide brass control valves with 200 PSI rated globe style valve sized per plans, Rainbird, Toro or Hunter, complete with valve boxes, with matching lids and extensions as required and shown on design details.

## 2.5 MISCELLANEOUS EQUIPMENT

- A. Valve boxes: Provide Jumbo 12" valve boxes with extensions as needed, weather tight enclosures and locking lids.
- B. Swing joints, irrigation risers: Refer to details.
- C. Electrical splice connection: Provide watertight connectors for all wire splices only within valve boxes. Approved socket connector manufacturers are Pen-Tite PVC, Scott's, or 3-M, DBY.
- D. Field control wire: Provide insulated single strand copper wire designated for 600 volts and UL approved as type "UF" underground feeder. Wire size shall be No. 14, with conductor meeting or exceeding ASTM B-3. Red, white and black colors shall be provided.
- E. Controller:
- Rainbird 24 Sta. ESP-MC
  - Irritrol 24 Sta. MC-Plus
  - Weathermatic 24 Sta. LMC24
- F. Drain: Utilize removable plug in double check valve vault and quick coupler valve blow down assembly to fully drain all main and lateral lines.
- G. Backflow Preventors: Bronze construction of body and caps. All internal parts shall be corrosion-resistant materials. Each check valve shall be a "Y" configuration, spring-loaded, center-guided, poppet type. Normal open with flow demand. All internal parts must be serviceable without removing device from line. Rating of 175 psi working pressure and water temperatures from 32°F to 140°F. Provide device with ball valves. Complete assembly, per detail, State, County and City codes.
- H. Quick Coupler Valves:
- Red brass body and bonnet for long life and rugged performance.
  - Locking purple thermoplastic covers to restrict tampering.
  - Covers marked with **"Do Not Drink!"** warnings in English and Spanish to prevent ingestion.

- Two-piece body design for easy servicing.
  - Strong corrosion-resistant stainless steel spring prevents leakage.
  - Pressure: 5 to 125 psi
  - Flow: 10 to 70 GPM size per irrigation legend
- I. Gate valves shall be class 150 bronze construction conforming to ASTM B-62 requirements. Gate valves shall be double disk, taper seat, with non rising stem, union bonnet and keyable hand wheel.
- J. Deduct Meter: General contractor shall provide a two-inch meter registering in cubic feet in accordance with AWWA C700-95 (Cold-Water Meters – Displacement Type, Bronze Main Case). See attachment for list of manufacturers and vendors.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Verify grade conditions: All finish grading shall be completed prior to this work. No other grading shall be required except that required for trenches and heads. Contractor shall not proceed with irrigation until grades have been examined and accepted.
- B. Locations of existing and proposed irrigation components shall be verified by Contractor before proceeding. Any discrepancies shall be brought to the immediate attention of the Contracting Officer.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system. All mainline, lateral line and controller wire shall be placed in separate Schedule 40 sleeves under paving. Sleeves shall be of adequate size to facilitate easy installation of pipe or wire. Pipe sleeves are estimated on the plans and shall be sized by the irrigation contractor. All sleeves are to be provided and installed by the irrigation contractor other than those labeled on the plans as existing.
- D. Protect features remaining as final work.

### 3.2 TRENCHING

- A. The Contractor shall provide all excavation necessary for the installation of the work.
- B. Depths of minimum cover unless otherwise specified:
- (1) Mainline: 18"
  - (2) Lateral Line: 12"



- (3) Wiring: 18"
- (4) Under walks, drives roadways: 24"

- C. Wherever possible parallel lines shall occupy a common trench.
- D. Trenches shall be dug straight unless accepted otherwise by the Contracting Officer. Trench bottoms shall be a true gradient providing support to pipe throughout its entire length. Trench bottoms shall be free from rocks, clods, and debris.
- E. The Contractor shall provide all necessary backfilling. Lines shall be carefully hand covered with select backfill to a six inch depth of cover to minimize danger of impact damage. Remaining backfilling shall be done in layers not over six inches deep, with all foreign matter, 1" in size and larger removed. Each layer shall be compacted to 95% such that there will be no settling.
- F. All surplus earth as a result of excavation by this Contractor shall be disposed of off-site in a legal manner.
- G. No backfilling shall be done until all lines and equipment to be covered have been tested as hereinafter specified. After backfilling, the area shall present a uniform surface, compacted to 95% density.
- H. Underground lines have minimum horizontal clearance of six inches from each other and of twelve inches from other utility lines unless approved by the Contracting Officer. This requirement does not apply to any lines crossing at angles from 45 to 90 degrees with each other. Maintain minimum two inch vertical clearance between lines which cross between these angles. No line is to be installed parallel to and directly over another line.

#### I. PIPING UNDER PAVEMENT

Conduits and Sleeves: Irrigation contractor shall coordinate with the paving contractor to have conduit provided under all pavement and at all designated locations on project. Conduit shall be Schedule 40 PVC and of sizes adequate to facilitate easy installation of irrigation main and lateral lines and wiring. Sleeves/Conduit shall be located and installed by irrigation contractor as shown on drawings.

### 3.3 INSTALLATION

- A. The Contractor shall exercise care in handling, loading, unloading and storing pipe and fittings to avoid damage. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and pipe is rejoined with a coupling.

- B. Welded joints shall be given at least fifteen minutes set-up time before moving or handling. No water shall be permitted in pipe until a period of at least four hours has elapsed for solvent weld setting and curling.
- C. Irrigation sprinkler heads: Shall be installed according to the detail drawings included in the construction documents. Minimum riser size shall be head inlet size of sprinkler heads. All threaded joints are to have Teflon tape or paste Teflon compound applied to male threads. Risers are to be capped after installation in preparation for pressure testing. Care must be taken to not over tighten the pipe into the PVC fitting at the sprinkler line-riser connection, or into other PVC threaded joints.
- D. Automatic Valves: Before installation of automatic valves, the supply line must be thoroughly flushed. All automatic valves shall be enclosed in valve boxes set at finished grade. Valve box extensions will be required. Install per detail drawing.
- E. Quick Coupler Valves: Install per detail drawings.
- F. Control Wires: Control wires shall be taped together at ten foot intervals. The wire harness shall be taped under the main line at 20 foot maximum intervals with at least three wraps of electrical tape. Splices will be permitted only at the valves. There must be a separate lead or "hot" wire to each automatic valve. One common ground wire will be acceptable. Two unconnected spare control wires are to be run through each intermediate valve box between controllers and each remote valve to limits shown. The control wires shall be color coded as follows: ground wire - white; lead-in wire - red; extra wire - black. As the control wires are being installed as described above, a bare copper wire, twelve gauge minimum will be installed on top of the main and lateral pipe lines for the purpose of possible future line detection search.
- G. Automatic Controller: Wall mount in the electrical/mechanical room at location shown on plans. Provide conduit for 24v control wires continuous from Controller to outside enclosure pad, as detailed. Provide 120 v power connection conduit and wiring per code. Coordinate exact controller location with general contractor and Contracting Officer.
- H. Backflow Preventor: Install complete assembly per County Health codes. Test and Certify per code at Contractors expense.
- I. Sprinkler heads are to provide total head to head coverage as designed, unless approved otherwise by the Contracting Officer.
- J. Deduct Meter: General contractor shall install or supervise installation of the meter in accordance with manufacturer's instructions. Meter shall be installed in vertical position with dial pointing upward. The meter shall be set in a meter setter under a meter box with reader lid located adjacent to building. The meter shall be located in a position such that

access will be provided Monday through Friday, 8 a.m. to 5 p.m. to Seattle Public Utilities staff without requiring protective equipment, mirrors, or ladders. Meter shall not be housed in a meter box requiring a combination or key for access. Coordinate meter installation with Seattle Public Utilities (Point of Contact: Karen McGrew, phone number: 206-684-5818). Contractor shall submit enclosed sub-meter inventory form to Seattle Public Utilities (see attached instructions). Meter shall be inspected by Seattle Public Utilities for billing purposes prior to placing in service. The Contractor shall coordinate for the required inspection with the Seattle Public Utilities Department.

### 3.4 DAMAGE TO PROPERTY AND OVERSPRAY

- A. Any of Owner's property, including equipment, piping, pipe covering, sewers, sidewalks, landscaping, etc., damaged by Contractor during course of his work shall be replaced or repaired by Contractor in a manner satisfactory to Owner at Contractor's own expense before final payment will be made.
- B. Contractor responsible for all damages caused by leaks in piping systems being installed or having been installed by him. Repair all damage so caused at Contractor's expense. All repair done as directed by him and in a manner satisfactory to Owner.

### 3.5 TESTS

- A. Prior to backfilling, all PVC Mainlines shall be flushed and pressure tested with all joints exposed to 150 p.s.i.-static pressure. Loss in lines will be visually checked and shall not be more than 5 p.s.i. in one hour. To be valid, all tests must be performed under the direction and supervision of the Contracting Officer. Any failure in the system to pass this test will require prompt correction by the Contractor and testing will continue until proven correct. Lateral Lines shall be capped and visually inspected with valve open, and subjected to static pressure within system. Any failure in lateral piping shall be repaired and retested.
- B. Contractor shall pre-test system components (main and each lateral) prior to approval test by the Contracting Officer or agent.

### 3.6 SYSTEM DEMONSTRATION

- A. Before the sprinkler system will be accepted, the Contractor, in the presence of the Contracting Officer, shall perform a water coverage test to determine if the water coverage and operation of the system is complete and satisfactory. If any part of the system is inadequate, in the opinion of the Contracting Officer, due to the Contractor's poor workmanship or materials, it shall be repaired or replaced at the Contractor's expense and testing will be continued until acceptable to the Contracting Officer.

### 3.7 WINTERIZING IRRIGATION SYSTEM

- A. The Contractor shall turn off and winterize entire system to prevent freezing damage at the end of the watering season during first year. The system shall be turned on by Contractor in spring and checked out to insure proper operation for coming season in first year. Blow system free of all water by air injection at P.O.C. and Q.C.V. and show maintenance personnel locations of all compressed air blow down valves on site for winterizing sprinkler system. Contractor shall be responsible for any damage resulting from freezing water in lines and improper winterizing of system during first year.

## SUBMETER INVENTORY FORM

Combined Utility Acct. Number: \_ \_ \_ \_ \_ - \_ \_ \_ \_

Service Address: \_ \_ \_ \_ \_

☐ Replacement of old meter: ☐no ☐yes - fill out below

Old Manufacturer name: \_ \_ \_ \_ \_

Old Manufacturer serial number: \_ \_ \_ \_ \_

Old read & Date: \_ \_ \_ \_ \_

☐ New Installation:

Manufacturer name: \_ \_ \_ \_ \_

Manufacturer serial number: \_ \_ \_ \_ \_

Number of digits on meter dial: ☐5 ☐6 ☐7 ☐8 ☐9  
(including fixed or painted 0's)

Number of fixed or painted 0's after rolling dials: ☐none ☐1 ☐2 ☐3

Verify meter reads in CUBIC FEET: ☐

Current read and date: \_ \_ \_ \_ \_ Installation date: \_ \_ \_ \_ \_

Meter Size: ☐3/4" or 5/8" ☐1" ☐1-1/2" ☐2"

Meter location: \_ \_ \_ \_ \_

Meter measures water used for: ☐irrigation ☐cooling ☐product ☐ships

Contacts: Reading access \_ \_ \_ \_ \_ Phone \_ \_ \_ \_ \_  
Maintenance \_ \_ \_ \_ \_ Phone \_ \_ \_ \_ \_

Please direct questions to KAREN McGREW (206) 684-5818  
BE SURE TO NOTIFY SPU IF YOU EXCHANGE OR MOVE YOUR METER

**METERS APPROVED FOR INSTALLATION IN CONNECTION  
WITH WASTEWATER CHARGES UNDER ORDINANCE #84390**

**METERS MUST REGISTER IN CUBIC FEET  
AND BE ACCESSIBLE TO METER READER**

CARLON	Familian Northwest, Inc. 7115 W. Marginal Wy. S.W. Seattle WA 98106	767-7700
HAYS	Romac Industries, Inc. 1064 4TH AV. S. Seattle WA 98168	624-6491
HERSEY	Branom Instrument Co. 5500 4TH AV. S. Seattle WA 98108	762-6050
PRECISION NEPTUNE	Pacific Water Works 415 S. Holgate St. Seattle WA 98134	223-0400
ROCKWELL	Fog-Tite Meter Seal Co., Inc. 4819 W. Marginal Wy. S.W. Seattle WA 98106	935-8000
SIGNET	Branom Instrument Co. 5500 4TH AV. S. Seattle WA 98108	762-6050
TRIDENT- NEPTUNE	Nebar Supply Co., Inc. 430 Minor Av. N. Seattle WA 98109	622-6292

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END OF SECTION

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## SECTION 02936

### SEEDING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Turf and Erosion Control Seeding

##### 1.2 RELATED SECTIONS

- A. Section 02275 - Temporary Erosion Control

##### 1.3 QUALITY ASSURANCE

- A. Contractor shall demonstrate competency in seeding in areas of work specified. Provide references for three years' prior work.

##### 1.4 JOB CONDITIONS

- A. Turf
  - 1. Complete all construction operations prior to final seeding to avoid damage.
  - 2. Seed prepared areas shown on the drawings. All turf seeding must be completed by September unless approved by the Contracting Officer.
  - 3. Warranty seeded area to be dense and well established through specified maintenance period and until final acceptance.
- B. Erosion Control Seeding: Seed areas as soon as possible after clearing and grading to provide early erosion control.

#### PART 2 PRODUCTS

##### 2.1 PROVIDE COMMERCIAL FERTILIZER AS FOLLOWS:

- A. For all seeded areas, provide fertilizer with 12% nitrogen, 24% phosphoric acid and 24% potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 20% of nitrogen to be organic form, slow-release urea formaldehyde. Apply at 5 lbs. per 1,000 square feet.

## 2.2 EROSION CONTROL SEED/MULCH TACKIFIER

- A. Seed shall be certified to be the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture and germination rate. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. seed that has become wet, moldy or otherwise damaged will not be acceptable.
- B. Mulch and tackifier shall be per the Standard Specifications applied at standard rates mulch 1 ton per acre and tackifier (if required) at manufacturer's recommended rates. Recycled paper/cardboard-mulch may be used without tackifier with Contractor solely responsible for performance.

## 2.3 SEED

- A. Seed shall be certified to be the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentage of mixture and germination rate. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy or otherwise damaged will not be acceptable.
- B. The seed shall be pre-mixed as specified below. Furnish grass seed mix in the following species:

### 1. Seed for Turf Areas:

#### Lawn Seed Mixture

40% Cascade Chewings Fescue  
20% Elf Perennial Ryegrass  
20% Shademaster Red Creeping Fescue  
10% Brightstar Perennial Ryegrass  
10% Shamrock Kentucky Bluegrass

### 2. Seed for Erosion Control Areas

#### Rough Grass Seed Mixture

8% Trifolium repens  
8% Vicia sativa  
8% Trifolium subterranean  
24% Dactylis glomerata

12% Lolium perenne  
24% Arrhenatherum elatius  
16% Festuca rubra

C. Seed at the following rates per acre:

Woodfiber Mulch	2,000 lbs.
Seed Mix	120 lbs.
Tackifier	40 lbs.

PART 3 EXECUTION

3.1 PREPARATION FOR TURF SEEDING

- A. Grade existing soils to finish grade and remove any irregularities and receive Owner's approval prior to seeding.
- B. Remove rocks and debris over 1/2" in any dimension, water settle, grade and compact to achieve an approved grade with variations not more than 1" in 10 feet. Seed shall not be placed until soils have established and further settlement is not apparent.
- C. Add all specified amendments and seed to hydroseed mix. Spread amendments uniformly over area to be seeded.

3.2 TURF ESTABLISHMENT

- A. Areas which have been damaged through any cause prior to final inspection and areas failing to have a uniform establishment of dense grass cover in the Owner's option shall be reseeded, refertilized and remulched at the Contractor's expense.
- B. Mowing is required 3 times minimum and refertilize as needed till turf is dense and fully established in opinion of Owner.

### 3.3 EROSION CONTROL SEEDING

- A. Provide erosion control seeding in all graded, bare or disturbed areas.
- B. Areas which have been damaged through any cause prior to final inspection and areas failing to have a uniform establishment of dense grass cover in the Owner's opinion shall be reseeded, refertilized and remulched at the Contractor's expense.
- C. No mowing required in erosion control seeding areas.

END OF SECTION

## SECTION 02950

### TREES, PLANTS, AND GROUND COVER

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Trees, Plants and Ground Cover.
- B. Soil Amendments, Mulch and fertilizer.
- C. Maintenance of Landscape Areas.

##### 1.2 RELATED SECTIONS

- A. Section 02811 - Irrigation System.

##### 1.3 ALLOWANCES

##### 1.4 REFERENCES

- A. American National Standards Institute (ANSI): Z60, 1-73 American Standard for Nursery Stock.
- B. Plant Nomenclature: L. H. Bailey Hortorium, (HORTUS THIRD, Macmillan Publishing Co., Inc., 1976, New York.)
- C. FS O-F241 - Fertilizers, mixed, commercial.
- D. Barrier Free Site Design, Housing and Urban Development, Vegetation Considerations.
- E. Nursery Stock Standards for Groundcovers, Young Plants, Vines, and Seedlings, State of Washington Department of Agriculture, July 26, 1973.

##### 1.5 DEFINITIONS

- A. Weeds: Includes but not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambquarter, Chichweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

- B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

## 1.6 OPERATIONS AND MAINTENANCE DATA

- A. Submit for the Contracting Officer's review a list of instructions for continuing Owner maintenance of landscape areas.
- B. Include cutting and trimming methods; types, application frequency, and recommended coverage of fertilizer.

## 1.7 QUALITY ASSURANCE

- A. Nursery: Company specializing in growing and cultivating the plants specified in this Section with minimum three years experience.
- B. Installer: State of Washington licensed landscape contractor specializing in installing and planting the plants specified in this Section with minimum three years experience.
- C. Deliver fertilizers and other soil additives in unopened containers bearing manufacturer's content labels showing contents, purity, batch number and manufacturer. Deliver plants to site in healthy, growing condition.
- D. Furnish certificates of inspection and compliance for plant and soil additives as required by Federal and State laws and regulations.
- E. Submit samples of proposed mulch, topsoil mixtures, and groundcover plants; include photographs of specimen plants and plant purchase order's data showing compliance with specified requirements; obtain approval ninety days before site delivery.

## 1.8 REGULATORY REQUIREMENTS

- A. Washington State Laws pertaining to Horticultural Inspection and Commercial Fertilizer.
- B. Plant Materials: Certified by State Department of Agriculture free of disease or hazardous insects.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Protect plants until planted, all plants to be winter hardened.
- D. Deliver plant life materials immediately prior to placement. Keep plants moist.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 30 degrees F or above 70 degrees F.
- B. Do not install plants when wind velocity exceeds 30 mph.

#### 1.11 SEQUENCING AND SCHEDULING

- A. Coordinate work under provisions of Division 1.
- B. Coordinate the work of this Section with installation of underground irrigation system.

#### 1.12 WARRANTY

- A. Following completion of all work in this Section and with the Contracting Officer's acceptance, warranty for a period of one year the landscape planting. The Contractor will be responsible for monitoring vitality of plant material for all conditions including soil moisture, insects, potential maintenance hazards, etc.
- B. Warranty: Include coverage of plants from death or unhealthy conditions.
- C. Replacements: Plants of same size and species as specified, planted in a timely manner. Replacement will be limited to one set of replacement plants.

#### 1.13 MAINTENANCE SERVICE AND PLANTING ESTABLISHMENT

- A. Scope and Duration

There shall be a one (1) year landscape establishment period under this Contract. This one (1) year period will begin on the day the landscape planting is declared complete by a letter from the Contracting Officer.

Landscape establishment shall also include but not be limited to watering of all areas and the applications of additional fertilizers as required; spraying for insects and/or disease as specifically approved by the Contracting Officer; tightening and repair of tree guying/staking; weeding of new planting areas; repair of erosion damage, and cleanup of soil mulch, etc., deposited on sidewalks, streets and gutters from any erosion.

B. Trees and Plantings

Weeds shall be removed from planting areas at least twice each month during the growing season (April 1st - October 1st) and at other times as necessary. Weed control, Roundup or equal, may be accomplished with herbicides IF SPECIFICALLY APPROVED BY OWNER PRIOR TO APPLICATION. All weeds and prunings shall be disposed of by the Contractor off the project site. Mulch shall not be allowed to scatter on paved areas.

C. Watering

All plants shall be watered by the Contractor as needed to keep them in healthy growth. The Contractor shall be responsible for his/her watering patterns and timing, including setting automatic sprinkler controls. Automatic watering shall be done some time during the time period of midnight to four (4) a.m.

1.14 SITE CONDITIONS

- A. Locate all underground utilities prior to digging or driving stakes.

PART 2 PRODUCTS

2.1 NURSERIES

2.2 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants, and Ground Covers shall conform to ANSI Z60, 1-73 American Standard for Nursery Stock specifications and shall be true to name per Hortus Third. Plants shall be first quality, well-foliated with well-developed root systems and normal well-shaped trunks, limbs, stems and heads.
- B. All plant material shall be labeled by genus, species and variety.
- C. Plants deemed unsuitable may be rejected before or after delivery and/or planting.
- D. All plant material shall be free from disease, insects, insect eggs and larvae.
- E. Oversize plants may be used, but the contract prices shall not be increased.



- F. Root balls that are cracked, broken or dry will be rejected.
- G. Species and size identifiable in plant schedule, winter hardened and grown in climatic conditions similar to those in locality of the Work.

## 2.3 TOPSOIL

- A. Mix: Prepared topsoil to be a 3-part mixture of 3 parts sandy loam topsoil, 1 part compost and 1 part sand. Pre-mix topsoil off site. Mixture is to be free of weed seeds or noxious materials which may be detrimental to the health of the plant material.
- B. Topsoil shall meet the following sieve analysis:

<u>Sieve</u>	<u>% Passing</u>
3/8"	100%
# 10	85 - 100%
#100	10 - 30%
#200	0 - 10%
#270	0 - 5%

## 2.4 SOIL AMENDMENT MATERIALS

- A. Fertilizer "A" plant tabs shall contain 10% available nitrogen (one half derived from urea formaldehyde nitroform), 20% phosphoric acid (derived from super phosphate), and 20% potash (derived from sulphate of potash).
- B. Lime shall be dolomitic lime containing not less than 85% total carbonates; 50% passing No. 100 standard sieve and 100% passing No. 20 sieve.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

## 2.5 COMPOST

- A. Compost shall consist of weed and debris free screened mill run fir and/or hemlock sawdust blended with composted manure or air digested sewage sludge. Compost may be screened and professionally composted yard waste. The blended ingredients shall be composite a minimum of one year after blending. Approved products include Cedar Grove Mulch, GroCo, Steerco, Fertilmulch, or other suppliers if approved by the Contracting Officer. Approval by the Contracting Officer will be predicated on a certified agronomists test of mulch, favorably comparing its performance to the approved products.

## 2.6 ACCESSORIES

- A. Miscellaneous landscaping materials shall include all incidental and accessory materials, tools and equipment required for completion of landscaping. Work including but not limited to:
- B. Tree Stakes: Per details, not less than 8' feet in length.
- C. Ties and Guy Wires: No. 12 gauge galvanized soft steel wire and 6 inch by 1/2 inch black reinforced vinyl or rubber hose. All wire and hose to be reviewed by the Contracting Officer.
- D. Bark Mulch: Medium grind douglas fir or hemlock. Sample approved by The Contracting Officer.
- E. Landscape Fabric: 5 oz. 4V stabilized non-woven polypropylene material.
- F. Black Plastic Edging: Provide sample of heavy-duty commercial grade 5" black plastic edging to Contracting Officer for approval.

## 2.7 SOURCE QUALITY CONTROL

- A. Contracting Officer will determine the acceptability of the trees, plants and ground covers on site prior to planting. Contractor shall notify Contracting Officer seventy two hours before delivery of plants to site to arrange for inspection.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify with Contracting Officer that prepared subsoil is ready to receive work of this Section.
- B. Saturate soil with water to test drainage, mound plant as directed by Contracting Officer if poor drainage is present.
- C. Verify underground utilities location.

### 3.2 PREPARATION

- A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure the Contracting Officer's acceptance before start of planting work. Make minor adjustments as may be requested.

B. Preparation for Planting Lawns, Trees, Shrubs and Groundcover:

1. Loosen subgrade of all areas to a minimum depth of 3". Remove stones over 1-1/2" in any dimension, sticks, roots, rubbish and any other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
  - a. Spread mixed topsoil full width in all tree and shrub areas as required to meet lines, grades and elevations shown, minimum depth 4 inches in planted areas, after light rolling and natural settlement.

3.3 FERTILIZING IN SHRUB AREAS

- A. After initial spreading of topsoil, apply fertilizer in accordance with manufacturer's instructions. Place 20 pounds of fertilizer "A" and 50 pounds of lime per 1,000 square feet.
- B. Rototill and rip scarify with track dozers, thoroughly blending all ingredients to a minimum depth of 8 inches.
- C. Fine grade all areas to smooth, even surface with loose, uniformly fine texture. Remove all rocks and debris over 1 1/2" in any dimension. Roller compact, rake and drag all areas, remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
- D. Backfill/fertilizer: Backfill all tree, shrub and groundcover plant pits with three-way topsoil mix. Incorporate 1/4 pound of fertilizer "A" for each tree and 1/16 pound for each shrub into the top 2 inches of soil after planting.
- E. Lightly water to aid the dissipation of fertilizer.

3.4 PLANTING

- A. Place topsoil to the limits shown in the shrub and tree pit details.
- B. Following irrigation installation, locate and mark on-site locations for all plants using tagged markers indicating species and size of plant; obtain Contracting Officer's review before proceeding.
- C. Dig pits, full dimension as stated below, for plants circular in outline with vertical sides. Where debris, rubble, or hardpan is encountered, remove the deleterious material if it does not extend more than one foot beyond the designated limits of the plant pit. Dispose of excavated soil in required fill areas or off-site.

- D. For trees in native soil make pits minimum of 48 inches deep or 30 inches deeper than depth of ball or depth of roots, whichever is the deeper. Make pit a minimum of 24 inches larger in diameter than ball or spread of roots.
- E. For shrubs in native soil, make pits minimum of 18 inches deep or 12 inches deeper than depth of ball or depth of roots, whichever is the deeper. Make pit a minimum of 12 inches larger in diameter than ball or spread of roots.
- F. Planting of trees and shrubs: Locate and orient plants as directed by Contracting Officer for best appearance.
- G. Set plants in planters or center of pits on compacted three-way topsoil mixture as specified. If plant pits do not drain, raise top root system crowns to two inches above surrounding grade. Support root structure on pit run gravel mixture. Install black plastic edging between all turf areas and shrub beds. Install edging per manufacturer's recommendations.
- H. Carefully remove plants from containers and scarify root mass to compensate for pot-bound conditions. Place bare root plant materials so roots lie in a natural position.
- I. Set plants vertical. Set plants to bear same relationship with finish grade while planting mixture is being placed; backfill pits to 6 inches below finish grade, placing mixture carefully to avoid damage to roots and to fill all voids. When pit is approximately 2/3 full, compact by jetting and allow to soak away; continue to fill to specified level. Fill top 6 inches with three-way topsoil and soak for settlement.
- J. Spread a uniform 2 inch layer of medium bark mulch over tree and shrub pits.
- K. Finishing: After settlement of backfill, rake back mulch and place additional planting mixture as required to bring fill to required elevations; replace mulch and rake all planting beds smooth and even. Prune plants in accordance with standard horticultural practice. Prune after planting, not prior to delivery, and paint cuts and abrasions with approved tree wound paint.

### 3.5 INSTALLATION OF ACCESSORIES

### 3.6 PLANT SUPPORT

- A. Stake trees at time of planting; drive stakes vertically at least 48 inches into ground as close to tree as possible without damaging roots. Fasten tree to upper end of stake using ties adequate to support trees. Stakes should be secure against displacement and deflection.
- B. Tree caliper : 1 - 1 3/4 inches      1 stake with two ties  
Tree caliper : 2 - 4 inches      2 stakes with four ties

### 3.7 FIELD QUALITY CONTROL

- A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.
- B. Landscape subcontractor shall notify Contracting Officer for one combined inspection of all plant material at the site prior to plant installation and at the end of 1 year guarantee.

### 3.8 CLEAN UP

- A. The Landscape contractor shall be responsible for keeping planted areas free of debris and for keeping walks and roads free from dirt, debris, rock and sand throughout the course of the work. Upon completion of the contract, s/he shall remove all surplus material, equipment and debris from the site. All planted areas shall be rake-clean. All stairs and paved areas shall be wash-clean.

### 3.9 DAMAGE TO PROPERTY

- A. Any equipment, underground utilities, roadways or walks damaged by the Landscape Contractor shall be replaced and/or repaired at his/her expense, in a manner satisfactory to the Owner.

END OF SECTION

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## SECTION 03300

### CAST-IN-PLACE (CIP) CONCRETE

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES: ACI 301, Section 1.1, Scope

1. Furnishing of and paying for all labor, materials, services, equipment, and appliances required for execution, installation, and completion of all work specified herein and/or shown on the drawings.
2. Comply with the applicable provisions of ACI 301-89 "Specifications for Structural Concrete for Buildings" except as modified hereinafter as if they were written herein. A copy of ACI SP-15 (89) "Field Reference Manual" (which includes ACI 301-89 "Specifications for Structural Concrete for Buildings" and reference standards specified therein) shall be kept at the job site for ready reference.
3. Work included:
  1. Cast-in-place (CIP) concrete, floors, foundations, foundation walls, slabs-on-grade and mechanical equipment pads.
  2. Formwork for CIP concrete, with shoring, bracing, anchorage, openings for other affected work, form accessories, and stripping forms.
  3. Reinforcing steel bars, welded steel wire fabric, fabricated steel bar or rod mats for CIP concrete. Support chairs, bolsters, bar supports, spacers, and other accessories for supporting reinforcement.
  4. Finishing of concrete, floor slabs and toppings, concrete hardener, sealer, and/or slip-resistant coatings.
  5. Expansion and contraction, control joints in CIP concrete.
  6. Concrete curing and protection.
  7. Non-shrink grout including installation and forming.
  8. Equipment pads, light pole bases, flagpole base(s).

1.2 PRODUCTS NOT FURNISHED BUT INSTALLED UNDER THIS SECTION:

1. Install only, in accord with drawings provided, all embedded-type reglets, sleeves, anchors, coil rods, and/or other such devices embedded in the concrete for use in other sections of these specifications. Drawings and materials will be provided under the provisions of the appropriate specification sections. Drawings shall show proper location and installation.
2. Place the female section of wedge inserts or dovetail anchor slots shown, or as required and spaced, for masonry walls, partitions, and veneers as specified under Spec. Section 04200 or other such anchors as may be shown on drawings or required for other sections of work in these specifications. Male portion will be installed by using section.
3. Metal fabrications attached to concrete. See Spec. Sections 05120.

1.3 WORK EXCLUDED:

1. Concrete paving and walks are specified in Division 2 - Sitework.

1.4 RELATED SECTIONS:

1. Division 1, General Conditions of the Contract - Submittals - Shop Drawings, Product Data, and Samples
2. Division 1 - Quality Control and Testing Services
3. Division 1 - Material and Equipment - Product Options and Substitutions
4. Division 1 - Contract Closeout: Project Record Documents
5. Section 04311 - Concrete Masonry Units
6. Section 07620 - Sheet Metal Flashing and Trim
7. Section 09650 - Resilient Flooring
8. Section 09900 - Painting
9. Divisions 15 - Mechanical & 16 - Electrical: Concrete Bases for Mechanical Equipment

1.5 RELATED DOCUMENTS: Comply with pertinent provisions of the following referenced specifications and standards of good practice, as if they were included herein except where different requirements are shown on drawings or specified herein.



1. All CIP concrete work shall conform to the American Concrete Institute "Specifications for Structural Concrete for Buildings" ACI 301 including ASTM standards except as modified or supplemented herein.
  2. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 - "General Requirements," apply to work of this section.
- 1.6 REFERENCES: Comply with references in ACI 301, para. 1.4 and 1.5; and the following standards and publications are referenced in this specification which shall establish standards of good and acceptable practice for this project unless modified herein.
1. National Ready Mix Concrete Association, (NRMCA). Quality Control Manual, 1984.
    1. Quality Control Manual Section 1, Ready Mixed Concrete, Quality Control Guide
    2. Quality Control Manual Section 2, Ready Mixed Concrete, Quality Control Check List for Certification of Ready Mixed Concrete Production Facilities, 1984
    3. Quality Control Manual Section 3, Concrete Production Facilities
  2. Truck Mixer Manufacturer's Bureau (TMMB) Publication:
    1. Truck Mixer and Agitator Standards (Jan. 1, 1981; 10th Revision).
  3. U.S. Dept. of Commerce, National Bureau of Standards (NBS) Products Standards:
    1. PS 1-83 Construction and Industrial Plywood.
    2. PS 58-73 Basic Hardwood.
- 1.7 DEFINITIONS: ACI 301, Section 1.3 Definitions
- 1.8 CONTRACTOR QUALITY CONTROL/VERIFICATION: Perform work in conformance with Division 1 - Quality Control and ACI 301.
1. The Contractor shall maintain a Quality Control (QC) Program during the cast-in-place concreting operations covered by this section of specs. The QC Program shall include the following:
    1. Coordination, scheduling and monitoring of all sampling, testing and inspections required herein (whether the services is a part of the Contractor's QC Program or part of the Owner/Architect Acceptance/Verification operation).

2. Evaluation and selection of qualified producers/ suppliers/subcontractors and their conformance to the requirements of the Contract Documents.
  3. Preparation of appropriate procurement documents with adequate reference to the requirements of the Contract Documents.
  4. Scheduling and conducting installation and in-progress job conferences.
  5. Preparation, review, and submittal of CIP reinforced concrete shop drawings.
  6. Prequalification of proposed concrete materials and establishment of mix designs. Review and approve mix designs before submittals for approval.
  7. Conduct Quality Control tests and inspections herein designated as being the responsibility of the Contractor.
  8. Periodic monitoring and verification of producer/ supplier/subcontractor quality control procedures.
  9. Provide verification of conformance for all materials furnished. The Contractor shall designate a responsible qualified person to receive ready-mixed concrete at the job site to verify each truck load for appropriate quality for the portion of the work being placed.
  10. Make preplacement of concrete inspections: lines and grades, formwork, reinforcing steel, embedments, blockouts and embedded items.
  11. Review formwork design, construction, shoring and reshoring procedures and assure conformance with design parameters and loading conditions.
  12. Placement supervision: Pouring conditions, field tests of concrete, conveyance, placement and consolidation, finishing and curing.
2. Quality Verification Testing:
1. Testing services required for construction Quality Verification shall be as follows:
    1. Pre qualification of proposed materials including: Course and Fine Aggregated, Cement, Water, Admixtures, Reinforcing and Prestressing Steel and establishment or review of concrete mix designs (ACI 301 Chapter 3, Proportioning).
    2. NRMCA Certification or equivalent inspection of batch plant(s) and truck mixers before and during construction.

3. Other testing services needed as required to assure required Concrete Quality.
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3. Quality Verification Inspections: Inspection of the cast-in-place, reinforced concrete as required by applicable local building code and by ACI 318, Building Code Chapter 1. The Independent Inspection Agency specified in Division 1 will perform the inspections of cast-in-place reinforced concrete.
    1. Inspection to conform to the "ACI Manual of Concrete Inspection" and shall consist of the following services by the Project Inspector:
      1. Make intensive observations and investigations during construction of the CIP reinforced concrete portions of the project to promote conformity to the intent of the Contract Documents. These services shall be performed during form construction, placement of reinforcement, mix design; and mixing, conveying, placing, finishing, curing and protection of all concrete work specified herein.
        - (1) Review and approve batching and mixing facilities and operation.
        - (2) Review and approve concrete mix designs.
        - (3) Monitor and evaluate Testing Laboratory procedures in the testing of materials and verification of quality control in the production and delivery of concrete to the project.
        - (4) Observe forms and placement of reinforcing steel, embedded items, joints, etc. and verify same to be according to plans and specifications.
        - (5) Review concrete conveying and placing methods and equipment.
        - (6) Observe concrete placing, consolidation, finishing, curing, protection, repair, and/or patching.
        - (7) Keep a record of all inspections of the progress of the work, and of any pertinent facts relevant to this portion of the work.
      2. Project Inspector's duties is not to be confused nor will they replace any of the Contractor's supervisory functions; nor will engineering inspection in any way relieve the Contractor of his complete responsibility of these supervisory functions. General Contractor is solely responsible for the direction and supervision of the entire construction operation, the performance of materials and labor, safety of working conditions, and the ultimate quality of the structure. The Project Inspector's responsibility is to make detailed observations while the work is in progress to provide a large measure of assurance to the Owner and the Contractor that the concrete work is conforming to the intent of the Contract Documents. His role in no way serves as guarantor of the Contractor's work.

1.9 SUBMITTALS: Submit Under Provision of Division 1.

1. Reinforced CIP Concrete Shop Drawings:

1. The Contractor shall have prepared and submit for Contracting Officer's review reinforced concrete shop drawings for all cast-in-place concrete shown on the structural ("S") drawings. See Division 1 for description of types of shop drawings and related responsibilities. The following reinforced concrete shop drawings shall be included:

1. Rebar Placing Drawings: (ACI 315, "Detailing Manual" CRSI MSP-2 "Manual of Standard Practice). Show bar sizes, spacing, locations, and quantities of reinforcing and wire fabric and supporting and spacing accessories. Provide steel order lists including bending and cutting details for all reinforcement shown or called for on the structural "S" drawings.
2. CIP Concrete Shop Drawings shall be prepared for all CIP Structural Concrete and submitted in accordance with Division 1 for Shop Drawing approval.
3. All work covered by shop drawings is to be constructed in accordance with the approved shop drawings.

1.10 VERIFICATION/ACCEPTANCE TESTING AND INSPECTION: (See Spec. Division 1)

1.11 TESTING LABORATORY SERVICES:

1. Comply with general requirements of Division 1, and ACI 301, Chapter 16. The testing laboratory shall provide the following:
  1. Review the Contractor's prequalification tests, and certifications for CIP Concrete Materials and evaluate for conformance to Contract Document requirements and advise Contracting Officer. (ACI 301, Chapter 16).
  2. Procure random samples of the concrete as it is discharged from the mixer/truck at the jobsite and just prior to being deposited in the forms and conduct strength tests as specified in ACI 301, Chapter 16.
  3. In addition to the requirements and duties in ACI 301, Chapter 16, the testing lab shall provide the following:
    1. Review and evaluate Concrete Mix Designs submitted by the Contractor before submittal for Contracting Officer's Review.

2. Review Manufacturer's reports and/or certification for each shipment of cement and reinforcing steel and/or conduct spot checks and laboratory tests of the materials as received for compliance with specifications.
  3. Inspect concrete batching, mixing, and delivery operations periodically or as directed.
  4. Sample (and test when directed) cement and aggregates and verify approved admixtures. Store samples in a protected place until authorize to dispose of them.
  5. Submit to the Contracting Officer, Concrete Producer, Contractor, and Owner during construction, the results of concrete tests. As a minimum include the following information:
    - (1) Weight of concrete - ASTM C138.
    - (2) Slump - ASTM C143
    - (3) Air content of freshly-mixed concrete by the pressure method, ASTM C231 or the volumetric method, ASTM C173 or ASTM C567 for lightweight concrete.
    - (4) Concrete temperature (at placement time).
    - (5) Air temperature (at placement time).
    - (6) Strength determined in accordance with ASTM C39.
  6. Other testing or inspection as required by the owner or his representative.
4. Periodic field and concrete plant inspections made by a competent representative of the Testing Laboratory during structural concreting operations including audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill specification requirements, the Testing Laboratory is to report such deficiency immediately to the Contracting Officer and appropriately record it in his report.
  5. Concrete reinforcement verification and/or testing:
    1. Receive and evaluate mill test certifications for conformance with contract document requirements. Perform quality tests if in the absence of identifiable mill test certifications the quality is in doubt at the cost of the Contractor.

1.12 EVALUATION AND ACCEPTANCE OF CONCRETE AND STRUCTURE: ACI 301, Chapter 17 and 18

### 1.13 PREINSTALLATION CONFERENCE

1. Prior to any construction of the concrete portions of the project, the Contractor is to call a preinstallation conference, including the project superintendent, his concrete foreman, subcontractors for this portion of the work, the Testing Laboratory, and others as the Contracting Officer may direct. The purpose of this meeting is to review the requirements of the Contract Documents to assure complete understanding of the specific responsibilities of each participant and his relationship with the others involved.

### 1.14 PROJECT RECORD DOCUMENTS

1. Submit under provisions of Division 1.

## PART 2 - PRODUCTS (ACI 301, Chapter 2)

### 2.1 GENERAL

1. See General Notes on structural drawings for specific requirements (i.e., type concrete and reinforcing, design assumptions, formwork and flat work finishes, tolerances, etc.). Otherwise, conform to ACI 301 except as herein modified. All materials are to be certified by the Manufacturer or sampled, pretested and approved before use.

### 2.2 CONCRETE MATERIALS

1. Cements: ACI 301, Section 2.1
  1. Portland Cement: ASTM C150 - Type I or II unless otherwise approved.
  2. The Contractor shall assume responsibility for verification of the quality and soundness of cement. Cement is to be of one type and from the same mill; it is to be of uniform color for all concrete with exposed architectural concrete finishes.
  3. Where the identity of the cement can be maintained, the Manufacturer's Mill Test Reports may be accepted as certification of pretesting of cement to be used. Where the delivery methods make it impractical to pretest and/or maintain proper identity of the tested cement, pretesting may be waived; in which case, samples are to be taken of all shipments of cement used and retained by the Testing Lab for a period of one year. Such samples are to be tested when directed to verify conformance.
2. Admixtures: Refer to ACI 301, Sections 2.2 and 3.7; and ACI 212.2R. The following admixtures are permitted or are required as specified herein and are to be used in strict accordance with the Manufacturer's specifications or recommendations; Admixtures

containing calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted:

1. Calcium chloride: Conform to ACI 301, Chapter 3. Certification of conformance to these requirements and the chloride ion content will be required from the manufacturer prior to mix design review.
2. Air-entraining admixtures: ASTM C260 shall be used to achieve the specified air content in all permanently exposed exterior concrete. (See ACI 301, Chapter 3)
3. Water-reducing admixtures: ASTM C494, Type A, containing not more chloride ions than allowed in par.1 above.
4. Water-reducing/accelerating admixtures: ASTM C494, Type C or E having long-term test results showing non-rusting on metal deck and reinforcing steel.
5. Water-reducing/retarding admixtures: ASTM C494, Type D containing not more than 1% chloride ions.
6. High-Range/Water-Reducing (HRWR) admixtures: ASTM C494, Type F or G super plasticizers containing 0.05% maximum chloride ions may be used with low slump (3" maximum) concrete to produce flowable concrete (up to 8" slump) with early strength gain and 28-day strengths equal to reference concrete. HRWR admixture may be used providing not more than 60 minutes is allowed from addition of admixture to final placement of concrete. HRWR admixture shall be used in concrete with a maximum water/cement ratio of 0.50 or less.
  1. Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D, & E) may be used.
7. Fly ash - ASTM C618: The use of a quality fly ash will be permitted as a cement-reducing admixture (maximum 20%). The fly ash shall be from a single source and meet all of the requirements of ASTM C618, Class C or Class F, with the following special requirements: The loss on ignition in Table 1 shall not exceed 3%. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 20%. The chemical analysis of the fly ash shall be reported in accordance with ASTM C114. Quality assurance testing and reports for a minimum of six (6) months shall be submitted by the fly ash supplier. The option to use fly ash must be approved prior to use.
8. Certification: Certification of the above requirements is required from the admixture manufacturer prior to mix design review and approval by the

Contracting Officer. Use of admixtures, other than listed above will be permitted only when approved prior to bidding.

3. Aggregates: ACI 301, Chapter 2, and ACI 221R.

1. Normal-weight concrete - ASTM C33.
2. All concrete exposed to the weather shall conform to the limits of deleterious substances and physical properties of Table 3, ASTM C 33.
3. Local aggregates: Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Contracting Officer.
4. Lightweight concrete - ASTM C330 and ACI 213: Lightweight aggregates shall produce a concrete with a splitting tensile strength (ASTM C496) of not less than 310 psi and a dry weight of not more than 115 pounds per cubic foot after 28 days. Limit shrinkage to 0.03% (0.10 in ASTM C330) at 28 days.
5. Maximum size of coarse aggregates: ACI 301, Chapter 3.

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1. Abrasive aggregates non-slip finishes: Fused aluminum oxide grits, or crushed emery, as abrasive for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rust-proof, non-glazing, and unaffected by freezing, moisture, and cleaning materials.

4. Water: Meet requirements of ASTM-C94

2.3 GROUT/MORTARS: The use of non-shrink grout is primarily for doweling to existing work, setting anchor bolts, etc.

1. Cement grout (ASTM C 476-80 Grout for Reinf. & Non-reinf. Masonry), dry-pack grout (ASTM C387, Dry packaged Mixtures), or:
  1. Mix at the site, in composition of one volume of portland cement to 2-1/2 columns of fine aggregate.
  2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
  3. When grout is used as dry-pack concrete, add sufficient water to make a stiff mixture which can be molded into a sphere.



2. High strength non-shrink grout: Corps of Engineers Specifications, (CRD-C-621-83), prepackaged factory-premixed grout, Type B (metallic). It shall be tested at a fluid consistency (flow cone) of 20 - 30 seconds. Grout shall attain 7000 psi compressive strength at 28 days at above floor and shall not bleed. Expansion shall not be caused by gas liberation. Include Manufacturer's certification that materials meet specification requirements.

1. Submittals: The following laboratory test results shall be submitted to show compliance with the requirements of this specification:

1. Initial setting time: 8 hours maximum
2. Vertical shrinkage; 0

2. Field service: The Contractor, when required, shall provide a qualified concrete technician employed by the Grout Manufacturer to assist in the initial grouting operations.

#### 2.4 REPAIR OF SURFACE DEFECTS: ACI 301, Chapter 9

1. Bonding Agent; Epoxy Type:

1. "Resiweld Concrete Bonding R7650 Adhesives", H.B. Fuller Company
2. "PR-930", Products Research Company
3. "Epoweld 812", Coast Pro-Seal & Mfg. Company
4. "Sta-Crete T1", Sta-Crete, Inc.
5. "Euco Epoxy #463", The Euclid Chemical Company
6. "Sikadur Hi Mod", Sika Chemical Company
7. "Epoxitite 2390", W.R. Grace Company
8. "Probond 812C" - Prokrete Industries

Use bonding agent where patching is allowed for certain concrete, subject to the Contracting Officer's approval. Apply in accordance with the manufacturer's printed instructions.

2. Patching and Surfacing Compound; Epoxy Type; 100% Solids:

1. "PR-940", Products Research Company
2. "Chemcrete", Protex-A-Cote, Inc.
3. "Resiweld 7640 Series" with sand aggregate, H.B. Fuller Company
4. "Sta-Crete 12" with sand aggregate, Sta-Crete, Inc.
5. "Sika Surface Kote" with sand aggregate, Sika Chemical Corp.
6. "Euco Epoxy #460 Mortar", The Euclid Chemical Company
7. "Epoxitite 2390 Mortar", W.R. Grace Company

3. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts:
  1. "Plasti-seal" by Euclid Chemical Company or equal.
  2. "Silca Pronto 19" (modified methacrylate crack healer) by Sika Chemical Corp.

## 2.5 CURING AND PROTECTION: ACI 301, Chapter 12

1. Liquid membrane-forming compounds for curing concrete, nonresidual - ASTM C309, Type 1, Class A or B or Federal Specification TT-C-800, Type 1-D fugitive dye. Curing compound shall be compatible with floor sealer or finish specified, and approved before use on project.

Submit product data, product characteristics, compatibility and limitations; installation instructions for preparation and application.

2. Joint Sealer:
  1. Joint sealer shall be a ready-mixed, non-staining compound utilizing a liquid polymer of the acrylic type, when exposed to the atmosphere, a solid elastomeric type compound will result, without the addition of heat or pressure. The compound shall be "Mono-Lasto-Metric" as manufactured by the Tremco Manufacturing Co., or approved equal. The color of the compound shall be as selected by the Contracting Officer.
  2. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts. Plasti-seal by Euclid Chemical Co. or equal.

## 2.6 JOINTS AND EMBEDDED ITEMS: ACI 301, Chapter 6

1. Construction Joints: ACI 301, Sec. 6.1
  1. Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to the Contracting Officer.
  2. Provide keyways at least 1-1/2" deep in construction joints, unless shown otherwise on plans, in walls, slabs and between walls and footings.
  3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

2. Expansion/Contraction Joint Filler: (ACI 301, Chapter 6)
  1. Install premolded expansion joint filler 1" thick unless otherwise indicated of the following types:
    1. Asphalt - impregnated fiberboard (ASTM D 1751, for interior work)
      - (1) "Flexcell" - Cleotex Corp.
    2. Self expanding corkboard (ASTM D 1752, Type III) for exterior work.
    3. Fiberboard/GlassFiber - (ASTM D 994)
      - (1) Flexcell - Celotex, Corp.
      - (2) Fiber Expansion Joints - W.R. Meadows, Inc.
    4. Polyvinyl/polystyrene (ASTM D 1752)
    5. Sponge Rubber (ASTM D 1752, Type 1)
  2. Hot-poured type shall conform to Federal Specification SS-S-1401. (Joint Seal #9005 - Prokrete Industries)
3. Contraction Joints in Slabs-on-Ground: Construct contraction joints in slab-on-ground to form panels of patterns as shown (16'-0" oc maximum). Use Zipstrip, Greenstreak or equal inserts 1/8" to 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints may be formed by saw cuts made as soon as possible after slab finishing as may be safely done without dislodging aggregate. Submit sawing schedule to the Contracting Officer for review.
4. Isolation Joint Fillers: Fillers shall consist of 1/8 inch width strips of neoprene; synthetic rubber, or approved substitute, extending the full depth of the slab.
5. Water Stops: (ACI 301, Chapter 6) Splice, seal, and install water stop for watertight joint as recommended by manufacturer and designed to allow for the anticipated movement at the joint.
  1. PVC - Corps of Engineers, CRD-C572, minimum 1750 tensile strength, minus 51 degrees F (minus 46 degrees C) to plus 175 degrees F plus 79 degrees C) working temperature range; flat profile; of the sizes and profile shown on drawings.
  2. Rubber - Corps of Engineers, CRD-C513

3. Neoprene - Corps of Engineers, continuous maximum lengths; 60 Shore A hardness; 2000 psi minimum tensile strength; recessed from joint; vertical turns; lubricant/adhesive; black color.
  4. Copper - Minimum 16 ounce copper; temper; maximum possible lengths.
- 2.7 VAPOR BARRIER: Provide cover over prepared base material at slabs-on-grade unless shown otherwise on drawings. Use only materials which are resistant to decay when coated and tested in accordance with ASTM E 154.
1. Provide polyethylene sheet not less than 8 [6] mils thick, or
  2. "Moistop 1" (or "2 Premium") - Fortifiber Corp., or
  3. Vapor Permeance Rating < 0.5 perm. as determined by ASTM E96, Procedure E.
- 2.8 STORAGE OF MATERIALS: ACI 301, Chapter 2.
- 2.9 PROPORTIONING: ACI 301, Chapter 3, either method, para. 3.9 or 3.10.
1. Concrete types and strengths: See General and Specific Notes on structural drawings.
    1. Weights: All concrete shall be normal-weight (N.W.) concrete unless otherwise designated on the structural drawings.
    2. Durability: ACI 301, Section 3.4.
      1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to deicer chemicals is to be air-entrained, (ACI 301 Table 3.4.1) water-cement ratio less than 0.53 by weight, six sacks cement/cu. yd. min., 4" max. slump. All concrete subject to aggressive chemical exposure in designated areas shall conform to the recommendations of ACI 201, Chapter 2.
      2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added to meet specified slump in accordance with the requirements of ASTM C94 unless otherwise noted.
  3. Slump: ACI 301, Section 3.5
    1. 4" maximum for consolidation by vibration
    2. 5" maximum for consolidation by other methods
    3. 8" maximum for flowable concrete. Concrete containing HRWR admixture (super plasticizer): 3" maximum before addition of HRWR.

4. Where field conditions require slump to exceed that specified above, the increased slump shall be obtained by the use of a superplasticizer only, and the Contractor shall obtain written approval from the Contracting Officer who may require an adjustment to the mix.
4. Selection of proportions (mix design): ACI 301, Chapter 3 and ACI 211.1.
5. Mix Designs:
  1. Mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301, Section 3.8 through 3.14. The testing facility shall not be the same as used for field quality control testing and inspection unless otherwise acceptable to Contracting Officer.
  2. Submit written testing laboratory reports to the testing laboratory for review for each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and verified by the Testing Laboratory to be in conformance with these specifications and approved by the Contracting Officer. Include the following information for each concrete mix design:
    - (1) Method used to determine the proposed mix design
    - (2) Gradation of fine and coarse aggregates
    - (3) Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
    - (4) Water-cement ratio
    - (5) Slump, ASTM C143
    - (6) Certification of the chloride content of individual admixtures and of the mixes as proposed.
    - (7) Air Content: ASTM C173 (Volumetric Method)
    - (8) Unit weight of concrete, ASTM C138
    - (9) Strength at 4, 7, and 28 days, ASTM C39
    - (10) Method of recording batch proportions
    - (11) Substantiating test reports which have been reviewed and approved by the independent testing lab.
2. Production of concrete: ACI 301, Chapter 7.
  1. Ready-mixed concrete:
    1. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.

2. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes. A certified copy of the design weights of ingredients for each mix shall be kept at the producing plant for each class of concrete used on the project.
3. Plant equipment and facilities are to conform to the "Check List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association and have NRMCA or other approved certification within the past year. No switching of plants will be permitted without prior approval. Truck mixers, agitators, and non-agitating units shall comply with Truck Mixer Manufacturer's Bureau "Truck Mixer and Agitator Standards."
4. Automatic batching plant shall either:
  - (1) be equipped with an approved accurate recorder which will provide a permanent and continuous record of batching operations. A recording unit in lockable enclosure shall be provided with each plant. Each recorder shall produce a graphic or digital record on charts, tapes, or tickets and shall provide the following information:
    - (1) The quantity or batched weights of each aggregate, cementitious material, and water.
    - (2) The zero balance condition of each scale after batchers have been discharged or prior to the start of the batching operation.
    - (3) A means of identifying each admixture required.
    - (4) The time and date of each batch delivered (required on one chart only).
    - (5) Mix formula or concrete classification identification (where more than one class) is required.
    - (6) Batch number for each batch delivered
  - [OR]
  - (2) An independent testing laboratory approved by the Contracting Officer shall be employed by the Contractor to observe and record all concrete batched at the plant for this project.

2. All other concrete: ACI 301, Chapter 7

3. Concrete produced by on-site volumetric batching and continuous mixing if approved shall conform to ASTM C685.
4. Use of accelerating admixtures in cold weather and retarding admixtures in hot weather shall not relax placement requirements specified herein.
5. Admixtures: All concrete placed at ambient temperatures below 50 degrees F is to contain an approved accelerator. All concrete placed at ambient temperatures above 80 degrees F is to contain an approved retarder. All concrete required to be air-entrained is to contain an approved air-entraining admixture. When approved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.
6. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements, the Contractor shall adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. The Contractor shall maintain on the job at all times adequate extra cement to be used at rate of 1/2 sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct awareness of the laboratory inspector.
7. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant at no additional cost to Owner. Laboratory test data for revised mix design and strength results must be submitted to the Independent testing lab and accepted before using in work.

2.10 FORMWORK: Conform to ACI 301, Chapter 4 Formwork.

1. The project inspector may observe formwork before the concrete is placed, but the Contractor is solely responsible for adequately constructing and maintaining the forms so that they will be safe, function properly, and produce the required results. Such observation is intended to ascertain that the formwork is deemed capable of producing the final product as specified.

2. Form Materials for Structural Concrete: (Surfaces covered with other finishes - not exposed to view after completion of project).

1. Wood form materials:

1. Plywood: USDC PS-1-83 Moisture-resistant, concrete form plywood commercial standard Exterior grade, edges sealed.
2. Lumber: No. 2 dressed lumber: Southern yellow pine, white pine, or Douglas fir.
3. Nails, spikes, lag bolts, through bolts, ties, and anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while pouring concrete

2. Tolerances: ACI 301, Chapter 4

3. Removal of Forms: ACI 301, Chapter 4 Section 4.5 - 4.7.

#### 2.11 REINFORCING MATERIALS ACI 301, Chapter 5.

1. General: Submit shop drawings in accordance with this Section and Division 1 showing all fabrication dimensions and locations for placing reinforcement and bar supports. Acceptance shall be obtained before fabrication.

2. Reinforcement: ACI 301, Section 5.2

1. Reinforcing bars - All reinforcing bars shall be deformed bars conforming to the following specifications as appropriate:

1. Reinforcing bars (rebars): Grade 60, deformed (ASTM A615, A616 or A617). Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

- (1) Fabrication and detailing: ACI 315.

- (2) Tolerances: ACI 301, para. 5.6

2. Welded Steel Wire Fabric: ACI 301, sub-para. 5.2.5, - ASTM A185.

3. Accessories: (ACI 301, para. 5.7) - As called for in the ACI Manual of Standard Practice for Detailing Concrete Structures (ACI 315), the CRSI Manual of Standard Practice (MSP-2), or other approved suitable types approved unless specifically shown otherwise on plans.



4. Fabrication and placement: ACI 301 Section 5.6 and ACI 315 or CRSI Reinforcing Bar Detailing (3rd Edition). Tolerances: ACI 301- Section 5.6.

## PART 3 - EXECUTION

### 3.1 GENERAL

1. Install all CIP concrete work in accordance with ACI 301 except as herein specified.

### 3.2 FORMWORK: ACI 301, Chapter 4 and ACI 347, Surfaces permanently exposed to view in the completed structure shall conform to ACI 301 para. 13.3.

1. Design and Installation of Formwork: ACI 301, Section 4.2.
  1. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
  2. Design and construct formwork, shoring, and bracing to meet design and code requirements so that resultant finished concrete conforms to required shapes, lines, and dimensions and will safely support the wet concrete. Contractor shall submit shoring and reshoring plan for review.
  3. Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal.
  4. Align joints and make watertight to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to a minimum.
  5. When using earth forms, hand-trim sides and bottoms and remove loose dirt prior to placing concrete.
  6. Tolerances: ACI 301, Section 4.3 Tolerances.
2. Construction Joints: ACI 301 para. 6.1.
3. Expansion Joints: ACI 301 para. 6.2.
4. Waterstops: ACI 301 para. 6.3.
5. Embedded items: ACI 301, Chapter 6.
  1. Installation of embedded items: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by

cast-in-place concrete. Use approved setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

2. Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on approved shop drawings or as otherwise specifically approved.
3. Install concrete accessories in accordance with Manufacturer's recommendations and straight, level, and plumb. Ensure that items are not disturbed during concrete placement.
4. Install water stops continuous without displacing reinforcement; seal joints watertight.
6. Openings: The Contractor shall form all mechanical openings except pipe and sleeve inserts. Pipes and sleeves are to be set by the appropriate subcontractor responsible for that portion of the work as approved.
7. Field quality control:
  1. The Contractor is to inspect and check completed formwork shoring and bracing to ensure that work is in accordance with formwork design and that supports, fastenings, wedges, ties, and parts are secure before placing concrete.

### 3.3 REINFORCEMENT: ACI 301, Chapter 5

1. Placement: ACI 301, Section 5.7.
  1. Place reinforcing, supported and secured against displacement, as indicated on approved rebar placing drawings.
  2. Reinforcing placement shall be inspected and approved by the project inspector before placement of concrete.
  3. Minimum Concrete Cover: ACI 301, Section 5.7.
    1. Provide 3/4" cover for all interior concrete walls and 1" cover for exterior walls with waterproofing.
    2. Provide 2" cover for all reinforcement in concrete which does not have a waterproofing membrane protection and is permanently exposed to earth or the elements.

3. Provide 3" cover for all concrete cast against and permanently exposed to earth.
4. Embedment, splices, & rebar development: ACI 318, Chapter 12.
5. Placement tolerances: ACI 301, Section 5.6.
6. Partially embedded reinforcing bars may be rebent if first preheated to 1100-1200 F. and bent as gently and in as gradual an arc as possible. Heating shall be performed so as to avoid damage to the concrete if within 6" of the concrete, use protective insulation.

3.4 CONCRETE (CONVEYING AND DEPOSITING): (ACI 301, Chapter 8) The Contractor shall have a qualified person available and responsible for receiving and monitoring concrete received from Ready-Mix supplier.

1. Preparation before placement: ACI 301, Section 8.3.
2. Conveying: ACI 301, Section 8.2.
3. Depositing concrete: ACI 301, Section 8.3 & ACI 304.
4. Protection of cast concrete: ACI 301, Section 3.4.
5. Repair of surface defects: ACI 301, Chapter 9 and Section 13.6.
  1. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections as needed or as directed.
  2. Modify or replace concrete not conforming to required lines, details, and elevations.
  3. Repair or replace concrete with excessive honeycombing and other defects due to improper placement. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of Contracting Officer for each individual area.
  4. Tie holes shall be filled solid with patching mortar.

3.5 SLABS-ON-GRADE

1. Slabs: ACI 301, Chapter 11 and ACI 3.02.1R-80 "Guide for Concrete Floor and Slab Construction".

1. Slabs-on-grade:
  1. Preparation of sub-grade (ACI 301, Section 11.2).
  2. Place floor slabs-on-grade by "strip cast" method. Contraction joints where shown on drawings shall be saw-cut 1/4 of the depth of slab thickness or a "Zip Cap" control joint former as manufactured by Green Streak Plastic Products, installed in accordance with the Manufacturer's recommendations.

### 3.6 SURFACE FINISHES

1. Finishing of formed surfaces: ACI 301, Chapter 10
  1. Tops of forms:
    1. Strike concrete smooth at tops of forms.
    2. Float to texture comparable to formed surfaces.
  2. Formed surfaces: ACI 301, Chapter 10
    1. Permanently exposed surfaces and surfaces to be painted [or to receive cementitious or textured (Aristex) ceiling coating (Section 09820)]: ACI 301, paragraph 10.2.2 - "Smooth Form Finish" with the fins ground smooth and air holes or honeycomb filled with mortar.
    2. Surfaces in unfinished areas unexposed to public view: ACI 301, para. 10.2.1 - "Rough Form Finish"
    3. Exposed concrete surfaces not to be painted or coated but exposed to public view: ACI 301, para. 10.3.1- "Smooth Rubbed Finish"
    4. Tolerances: ACI 301, Section 4.3, Table 4.3.1
2. Slab finishes:
  1. Floor: ACI 301, Chapter 11
    1. Finishes: Trowled finish, ACI 301, para. 11.7.3, Class A tolerance, ACI 301, Section 11.9. Verified by ACI 117-88 sec. 4.5.7.
  2. Abrasive non-slip aggregate finish: Apply non-slip aggregate finish to concrete stair treads, platforms and pedestrian ramps. After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened

non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose non-slip aggregate.

### 3.7 CURING AND PROTECTION: ACI 301, Chapter 12 and ACI 308-81

1. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven (7) days. Freshly placed concrete shall be protected against wash by rain. Apply the curing compound at a rate equivalent to the rate of application at which the curing compound was originally tested for conformance to the requirements of ASTM C309. Do not use Cure n' Seal type membranes. Do not use membrane curing when freezing weather is anticipated during first few days of curing period. Formed surfaces are to be protected and cured as above when forms are removed within the seven (7) day required curing period.
  1. Cold-weather concreting ("Cold-Weather Concreting" - ACI Report 306R).
  2. Hot-weather concreting ("Hot-Weather Concreting" - American Concrete Institute Committee 305).
2. All curing methods are to be placed immediately after final finishing (i.e., within two hours). Contractor's attention is directed to the fact that experience shows the most important time of curing is from three to four hours after placing and extending five to six hours thereafter. It is extremely important, therefore, to prevent loss of moisture, particularly during this period when concrete is especially vulnerable to shrinkage cracks.
3. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted.
4. All interior floor slabs to receive finish or carpet or to be left exposed shall be cured with the specified clear curing compound, ASTM C309 Type 1, Class A. The resulting surface is to be dust-free and compatible with all resilient floor adhesives, toppings, or other finish materials specified.

### 3.8 FIELD QUALITY CONTROL

1. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Division 1.
2. Provide free access to Work and cooperate with appointed firm.

3. Submit proposed mix design for each class of concrete to testing agency for review prior to commencement of Work.
  4. Samples of cement and aggregates will be taken and may be tested to ensure conformance with specified requirements.
  5. Test cylinders will be taken in accordance with ACI 301, Ch. 16 (ACI 318 para. 5.6) for each class of concrete placed.
  6. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
  7. One slump test will be taken for each set of test cylinders taken.
- 3.9 REMOVAL OF FORMS AND SHORES: ACI 301, Section 4.5, 4.6 & 4.7.
- 3.10 PATCHING AND REPAIR: ACI 301, Section 13.6 and ACI 503.2-79 Standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.
- 3.11 CHEMICAL SEALER/HARDENER FINISH: Colorless, aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent containing not less than two pounds of fluosilicates per gallon shall be used in accordance with the Manufacturer's recommendations in areas designated on the plans.
- 3.12 EVALUATION AND ACCEPTANCE OF CONCRETE: ACI 301, Chapter 17
- 3.13 ACCEPTANCE OF STRUCTURE: ACI 301, Chapter 18
- 3.14 MISCELLANEOUS CONCRETE
1. Curbs: Provide monolithic finish to interior surface of curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
  2. Equipment bases and foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
  3. Reinforced/grouted masonry: Provide concrete grout for reinforced masonry walls, lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.15 NON-SHRINK GROUT shall be used under all base plates and where ever called for on the drawings.

1. Build forms of materials of adequate strength and anchor and shore securely to withstand the pressure of the grout under working conditions. Forms shall be sufficiently tight to prevent leakage and shall be caulked where necessary. Adequate clearance between forms and bedplate shall be allowed to work the grout into place properly.
2. Preparation:
  1. All defective concrete, laitance, dirt, oil, grease, and loose material shall be removed from the concrete bearing surface by bushhammering, chipping, or other means until sound, clean concrete is obtained. The bearing surface shall be left reasonably rough but not so rough as to interfere with proper placing of the grout. The area shall be covered as completely as possible with waterproof paper to prevent contamination prior to grouting.
  2. The bottom of the setting plates shall be cleaned of all dirt, rust, oil, grease, and loose material. Setting plates shall be aligned and leveled in their final position and maintained in that position during grouting.
  3. Special care shall be taken with the grout in hot and cold weather to ensure proper setting and gain of strength in accordance with the information supplied by the manufacturer of the ready-to-use grouting materials.
  4. Prior to grouting, the waterproof paper shall be removed and all loose dirt and matter cleaned away by compressed air or other means. Remove oil, grease, and other foreign matter from the bearing surface and setting plate. Saturate concrete surfaces with water and scrub sides and bottom with a circular brush such as a bottle brush. Remove excess water from the surface just prior to placing the grout.
3. Mixing:
  1. Grout material and water shall be mixed in accordance with Manufacturer's recommendations in a mortar mixer to ensure even distribution of components.
  2. Mixer shall be as close as possible to the plate to be grouted. Adequate means shall be provided to transport the mixed grout to the plate being grouted as quickly as possible and in such a manner as to prevent segregation.

3. No more grout shall be mixed at one time than can be placed in a period of 30 minutes. After the grout has been mixed, it shall not be retempered by adding additional water.
4. Grouting:
  1. The grout shall be placed quickly and continuously to avoid undesirable effects of overworking or stiffening which might result in breaking down of the initial set.
  2. The grout shall be placed by the most practical means that results in completely filling the space to be grouted. The grout may be poured in place or pressure-grouted by gravity or a plunger. The use of pneumatic pressure or dry-packed grouting requires approval of the Contracting Officer.
  3. Whenever practicable, grout shall be poured from one side only so as to flow across to the open side to avoid air entrapment.
  4. Grout shall be thoroughly compacted and free of air pockets.
  5. Form shoulder and trowel smooth.

END OF SECTION



## SECTION 04100

### MORTAR AND MASONRY GROUT

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.
- B. Pre-bagged prepared mortar mix is not acceptable.

##### 1.2 RELATED SECTIONS

- A. Section 04270 - Glass Unit Masonry: Installation of mortar and grout.
- B. Section 04311 - Concrete Masonry Units: Installation of mortar and grout.
- C. Section 04320 - Veneer Masonry System: Installation of mortar.
- D. Section 04340 - Reinforced Unit Masonry System: Installation of mortar and grout.
- E. Section 08112 - Standard Steel Frames: Grouting steel door frames.

##### 1.3 REFERENCES

- A. ACI 530 - Building Code Requirements for Masonry Structures.
- B. ACI 530.1 - Specifications For Masonry Structures.
- C. ASTM C5 - Quicklime for Structural Purposes.
- D. ASTM C94 - Ready-Mixed Concrete.
- E. ASTM C144 - Aggregate for Masonry Mortar.
- F. ASTM C150 - Portland Cement.
- G. ASTM C207 - Hydrated Lime for Masonry Purposes.
- H. ASTM C270 - Mortar for Unit Masonry.
- I. ASTM C404 - Aggregates for Masonry Grout.
- J. ASTM C476 - Grout for Masonry.

- K. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- L. ASTM C1019 - Method of Sampling and Testing Grout.
- M. ASTM C1072 - Method for Measurement of Masonry Flexural Bond Strength.
- N. ASTM E447 - Test Methods for Compressive Strength of Masonry Prisms.
- O. ASTM E518 - Test Method for Flexural Bond Strength of Masonry.
- P. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Design Mix: indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- B. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.
- D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes.
- C. Store cementitious materials off the ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and

contamination avoided.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

### 2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I, gray.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Grout Course Aggregate: ASTM C404.
- E. Grout Fine Aggregate: sand shall pass a No. 16 sieve percent by volume.
- F. Water: Clean and potable.

### 2.3 MORTAR COLOR

- A. Mortar Color: Mineral oxide pigment; color as selected to match motor color on maintenance building.

### 2.4 MORTAR MIXES

- A. Mortar For Load Bearing Walls and Partitions: ASTM C270, Type M using the Property specification.
- B. Mortar For Non-Load Bearing Walls and Partitions: ASTM C270, Type S using the Property specification.
- C. Mortar For Engineered Masonry: ASTM C270, Type M using the Property specification.
- D. Pointing Mortar: ASTM C270, Type N using the Property specification.

## 2.6 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.
- F. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F.

## 2.7 GROUT MIXES

- A. Bond Beams, Lintels: 3,000 psi (21 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; mixed in accordance with ASTM C476 Fine grout.
- B. Engineered Masonry: 3,000 psi (21 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; mixed in accordance with ASTM C476 Fine grout.

## 2.8 GROUT MIXING

- A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 Fine grout.
- B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

## 2.9 MIX TESTS

- A. Test mortar and grout in accordance with Division 1.
- B. Testing of Mortar Mix: In accordance with ASTM C270.
- C. Testing of Grout Mix: In accordance with ASTM C1019.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Request inspection of spaces to be grouted.

### 3.2 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry sections. Use masonry "grout" in only walls constructed of masonry.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches (two CMU courses) without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Test and evaluate mortar in accordance with ASTM C780.
- C. Test and evaluate grout in accordance with ASTM C1019.
- D. Test mortar and masonry units to ASTM C1072, E447 and E518; test in conjunction with masonry unit sections specified.

END OF SECTION



## SECTION 04255

### NONBEARING MASONRY VENEER/STEEL STUD WALLS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Attachment of all brick veneer attached to steel stud back-up walls including masonry anchorage and accessories.
- B. Brick veneer shall conform to all applicable requirements of Section 04320 - Veneer Masonry System.
- C. Steel stud wall framing shall conform to all applicable requirements of Section 05400 - Cold Formed Metal Framing.

##### 1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC MO16 (1989; 9th Ed) Manual of Steel Construction

#### AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-671 (1986; Addenda 1989; Errata Nov 30, 1990) Cold-Formed Steel Design Manual: Part I Design of Cold-Formed Steel Structural Members

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 (1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 446 (1989) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A 525 (1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM C 79 (1991) Gypsum Sheathing Board

ASTM C 216 (1990a) Facing Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 578 (1987a) Preformed, Cellular Polystyrene Thermal Insulation

ASTM C 591	(1985) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM C 665	(1988) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 954	(1986) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster. Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 955	(1988) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
ASTM C 1002	(1988) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
ASTM D 226	(1989) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 1056	(1985) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(1985; R 1990) Rubber Sheet Gaskets
ASTM D 1667	(1976; R 1990) Flexible Cellular Materials -Vinyl Chlorine Polymers and Copolymers (Closed-Cell Foam)
ASTM D 2103	(1986) Polyethylene Film and Sheeting
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING (ASHRAE)	
ASHRAE-03	(1989) Handbook, Fundamentals I-P Edition
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.3	(1989) Structural Welding Code - Sheet Steel
DEPARTMENT OF COMMERCE (DOC)	
DOC PS 1	(1983) Construction and Industrial Plywood

### 1.3 RELATED SECTIONS

- A. Section 04100 - Mortar and Masonry Grout - Mortar and Grout
- B. Section 04311 - Concrete Masonry Units
- C. Section 04320 - Veneer Masonry System



- D. Section 05400 - Cold Formed Metal Framing: Structural wall backing.
- E. Section 07120 - Fluid Applied Waterproofing
- F. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work and placement of reglets for flashings.
- G. Section 07900 - Joint Sealers: Road and sealant at control and expansion joints.
- H. Section 09260 - Gypsum Board Systems: Structural wall backing.

1.4 SUBMITTALS: Submit under provisions of Section 01300.

A. Product Design Data:

a. Calculations or tabular data as necessary, demonstrating the structural performance of the cold-formed steel framing system for the specified loadings and deflection criteria in accordance with the provisions of AISI SG-671. Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loadings being supported. This analysis shall be in accordance with AISC MO16. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval.

b. Calculations demonstrating the insulation shown on the Detail Drawings provides the specified U-value for heat transmission of the completed exterior wall construction shall be submitted for approval. This analysis shall be in accordance with ASHRAE-03. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

B. Shop Drawings:

1. Details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel studs and other cold-formed steel framing members and of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

C. Samples: (Refer to Sections 04320 and 05400)

1.5 DELIVERY, HANDLING AND STORAGE (Refer to Section 04320 - Brick Veneer)

## PART 2 - PRODUCTS

### 2.1 BRICK VENEER (Refer to Section 04320)

### 2.2 MORTAR (Refer to Section 04100 - Mortar)

### 2.3 JOINT REINFORCEMENT (See Section 04311 - Unit Masonry)

A. Joint reinforcement shall be of steel wire conforming to ASTM A 82. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe.

### 2.4 COLD-FORMED STEEL FRAMING (Refer to Section 05400 - Cold-Formed Steel Framing)

A. Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. The cold-formed framing system shall be designed in accordance with AISI SG-671. The steel studs and other cold-formed steel framing members within the wall shall be designed to resist the entire wind and seismic loadings acting inward and outward perpendicular to the wall system without exceeding a deflection of 1/600 times the vertical stud span and AISI SG-671 allowable stresses. To prevent the masonry wythe from cracking due to "hard spot" support at doors, windows, and other openings, the completed design of the cold-formed steel system shall result in bending stiffnesses and deflections at openings that are compatible with those away from wall openings. Design calculations shall be submitted for approval. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 525 with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior masonry veneer steel stud wall system as indicated on the drawings.

#### B. Steel Studs Backup for Brick Veneer

Studs will conform to ASTM A 446, Grade A, having a minimum yield strength of 33,000 psi. The base metal thickness of studs shall be 0.043 inches (18 gage) minimum except where noted otherwise on the construction drawings. Studs that vertically support the masonry veneer, through shelf angles, shall have a minimum thickness of 0.0747 inches (14 gage) or heavier. Studs shall be the depth indicated on the drawings and shall have a minimum flange width of 1-3/8 inches with a minimum return lip of 0.25 inches. Section properties shall be determined in accordance with AISI SG-671.

#### C. Runners, Tracks, Bridging and Accessories

All cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 446, Grade A, having a minimum yield strength of 33,000 psi.

## 2.5 INSULATION (Refer to Division 7)

### A. Batt Insulation

1. Insulation placed between the steel studs shall be batt type fiber glass conforming to ASTM C 665, Type I.

## 2.6 GYPSUM WALLBOARD

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09260 - Gypsum Board System

## 2.7 GYPSUM SHEATHING BOARD CORE (Fiber Glass Mat Facing)

- A. Gypsum sheathing board core with fiber glass mats both sides is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 1/2 inch and shall be 4 feet wide. See section 09260 - Gypsum Board System for specification on the sheathing.

## 2.8 VENEER ANCHORS

A. Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel will be designed for the design loadings shown. Anchors will transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 1-1/4 inch from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 3/16 inch diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153, Class B-2. The veneer anchor shall have a minimum capacity of 200 pounds. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall not be less than 2000 pounds per inch (or a deflection of 0.05 inches per 100 pounds of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1/16 inch.

1. Adjustable Pintle-Eye Type Wire Anchors shall be two pieces rectangular type double pintle anchors.

## 2.9 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123 or ASTM A 153 as appropriate.

A. Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

B. Welding

All welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI SG-671. All welders shall be qualified in accordance with AWS D1.3. All welds shall be cleaned and touched-up with zinc-rich paint.

C. Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as required by design to provide the needed pullout load capacity but not less than No. 12. Screws shall be shown on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 5/8 inch.

D. Gypsum Sheathing Screws (See Section 09260)

Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to ASTM C 1002, Type S.

2.10 SYNTHETIC RUBBER WASHERS

A. Synthetic rubber washers for placement between veneer anchors and the moisture barrier on the outside face of the exterior sheathing shall conform to ASTM D 1330, Grade I.

2.11 FLASHING

A. Copper or stainless steel flashing shall conform to the requirements in Section 07620 Sheet Metal Flashing and Trim. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

2.12 STEEL LINTELS AND SHELF ANGLES

A. Steel shapes used for lintels and shelf angles shall conform to ASTM A 36. Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123.

2.13 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07900 - Joint Sealers.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

### 3.2 STEEL STUD WALL FRAMING

A. The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members as shown on the drawings. Top and bottom tracks shall be securely anchored to resist track rotation by alternating fastener locations to provide two rows, one row near each track flange as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced 16 inches on centers. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

### 3.3 STEEL SHELF ANGLES

A. Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 10 feet in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than four feet where possible. Elsewhere, shelf angles segments shall not be connected together but instead shall be installed with 1/4 inch wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC-02.

### 3.4 INSULATION (See Section 07213 - Batt Type Only)

A. Insulation shall be installed between wall framing members. Insulation shall be secured to the sides of the framing members to provide a continuous seal and so that the entire weight of the insulation is carried by the framing members. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

### 3.5 EXTERIOR SHEATHING

A. Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 3/8 inch from the ends and edges of sheathing panels and shall be spaced not more than 8 inches on each supporting member except at vertical slip joints, the sheathing should be connected to the vertical studs only so as not to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the moisture barrier. All holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

### 3.6 MOISTURE PROTECTION

#### A. Moisture Barrier

1. The asphalt-saturated felt or other approved moisture barrier shall be installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than 6 inches over the sheet below. Vertical end joints shall be lapped not less than 6 inches and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than 16 inches on center or as required by the manufacturer.

#### B. Vapor Retarder

1. A vapor retarder shall be installed between the steel studs and the gypsum wall board. The vapor retarder shall be installed in accordance with the manufacturer's recommendations to form a complete retarder to vapor infiltration. The joints shall be lapped and sealed with tape.

### 3.7 VENEER ANCHORS

A. Veneer anchors shall be attached with screws through the sheathing to the steel studs or other support members at the locations shown. Veneer anchors shall be installed with the outermost wires lying between 5/8 inch from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the moisture barrier. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each two square feet of wall and shall be attached to steel studs and other supports with a maximum spacing of 24 inches on center. For pintle-eye anchors the vertical distance between the pintle section horizontal wires and the eye section horizontal wires shall not exceed 1/2 inch.

### 3.8 MASONRY VENEER

A. Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of a 2 inch minimum width air space will be provided between the moisture barrier and the masonry veneer.

Masonry veneer will not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Longitudinal reinforcement consisting of at least one continuous galvanized steel wire shall be placed in the veneer wythe. The minimum wire size shall be 9 gage. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 1/2 inch into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

#### B. Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

#### C. Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 120 degrees F when laid. Masonry erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

#### D. Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

#### E. Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

##### Variation From Plumb

In adjacent units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

##### Variation From Level Or Grades

In 10 feet	1/8 inch
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

##### Variation From Linear Building Lines

In 20 feet	1/2 inch
In 40 feet or more	3/4 inch

##### Variation From Cross Sectional Dimensions Of Walls

Plus	1/2 inch
Minus	1/4 inch

#### F. Joint Reinforcement

Unless otherwise shown, joint reinforcement shall be spaced at 16 inches on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 6 inches. Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is 5/8 inches.

#### G. Veneer Joints

Brick expansion joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07900 - Joint Sealer. Horizontal reinforcement shall not extend through the joints.



#### H. Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 24 inches. Weep holes shall be placed in head joints just above the flashing. Weep holes shall be formed by installing head joint vents. Weep holes shall be kept free of mortar and other obstructions.

#### I. Head Joint Vents

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes.

#### J. Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Toothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and be held securely in place.

#### K. Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, all defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

END OF SECTION



SECTION 04270  
GLASS UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass masonry units.
- B. Mortar bed and pointing mortar.
- C. Perimeter treatment.

1.2 RELATED SECTIONS

- A. Section 04100 - Mortar and Masonry Grout: Mortar for glass unit masonry.
- B. Section 04311 - Concrete Masonry Units: Unit masonry system.
- C. Section 04320 - Veneer Masonry System: Brick Veneer.
- D. Section 05120 - Structural Steel: Placement of miscellaneous steel.
- E. Section 05500 - Metal Fabrications: Placement of fabricated steel items.
- F. Section 07620 - Sheet Metal Flashing and Trim: Sill and flashing construction under glass unit masonry.
- G. Section 07900 - Joint Sealers: Perimeter caulking and sealant tooled joints.

1.3 REFERENCES

- A. ASTM A123 - Zinc (Hot-Galvanized) Coatings of Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
- B. ASTM C270 - Mortar for Unit Masonry.
- C. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- D. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

- E. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.
- F. ASTM AC41 - zinc-coated (galvanized) carbon steel wire.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide data for glass units, fabricated wire reinforcement, accessories, and sealants.
- C. Samples: Submit four glass units illustrating size variations, color, design, and face pattern.
- D. Manufacturer's Installation Instructions: Indicate special procedures, positioning of reinforcement, perimeter conditions requiring special attention.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Accept glass units on site on pallets; inspect for damage.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

#### 1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS - GLASS UNITS

- A. Pittsburgh Corning, 800 Presque Isle Drive, Pittsburgh, PA 15239, Product: Vue Pattern.

### 2.2 GLASS UNITS

- A. Hollow Glass Units: Permanently seal hollow unit by heat fusing joint factory coat units edges to improve bond with mortar.
  - 1. Nominal Size: 8 x 8 x 7-3/4" inch (197 x 197 x 197] mm).
  - 2. Color: Clear glass.
  - 3. Pattern and Design: Vue Pattern.
  - 4. Insulation Value: U value of 0.51 BTU/sq ft/h/degree F.
  - 5. Compressive Strength: 400-600 psi (2.8-4.1 MPa)
  - 6. Visible Light Transmittance: 75 percent.
  - 7. Shading Coefficient: 0.65.
  - 8. Sound Transmission: 39 STC.

### 2.3 ACCESSORIES

- A. Panel Reinforcement: Steel, galvanized after fabrication to 1.25 oz/sq ft (380 g/sq m) in accordance with ASTM A123:
  - 1. Side Rods: Two 9 gage (4 mm) rods spaced 2 inches (50 mm) apart.
  - 2. Cross Rods: 14 gage (1.8 mm) rods welded 8 inches (200 mm) oc.
- B. Expansion Strips: Dense glass fiber matting, 7/16 x 4 inches (11 x 100 mm) nominal size.
- C. Panel Anchors: Steel strips, 20 gage (0.9 mm) thick x 1 3/4 inch (44 mm) wide; punched with three rows of elongated holes, pattern staggered, hot dip galvanized after fabrication to 1.25 oz/sq ft (380 gm/sq m) in accordance with ASTM A123.
- D. Perimeter Channel: Light gage steel channel profile, 1-1/2 x 5-1/2 - 12 ga. size, one piece per length installed.
- E. Intermediate Tee: Formed steel tee profile, WT4X6.5 size, one piece per length welded to light gage steel channels.
- F. Asphalt Emulsion: Water based.

## 2.4 MORTAR AND POINTING MATERIAL

- A. Mortar: ASTM C270, Type S using the Proportion specification as specified in Section 04100.
- B. Pointing Mortar: ASTM C270, Type N using the Property specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight, with beach sand aggregate.

## 2.5 MORTAR MIXING

- A. Mix mortar ingredients in accordance with Section 04100.
- B. Add and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F (5 degrees C).

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that openings are ready to receive work.

## 3.2 PREPARATION

- A. Clean glass units of substances that may impair bond with mortar or sealant.
- B. Establish and protect lines, levels, and coursing.
- C. Protect elements surrounding the work of this section from damage or disfiguration.

## 3.3 INSTALLATION

- A. Erect glass units and accessories in accordance with manufacturer's instructions.
- B. Locate and secure perimeter metal chase.
- C. Coat surface under units with asphalt emulsion as a bond breaker, and allow to dry.

- D. Set panel anchors in mortar bed directly over coating.
- E. Provide full mortar joints. Furrowing not permitted. Remove excess mortar.
- F. Maintain uniform joint width of 1/4 inch (6 mm).
- G. Place panel reinforcement at every second horizontal joint in full mortar bed and at first course above and below openings within the glass unit panel.
- H. Lap reinforcement joints 6 inches (150 mm). Discontinue reinforcement at expansion joints.
- I. Isolate panel from adjacent construction on sides and top with expansion strips concealed within perimeter trim. Keep expansion joint voids clear of mortar.
- J. Shore assembly until setting bed will maintain panel in position without movement.

### 3.4 TOLERANCES

- A. Variation From Joint Width: Plus or minus 1/8 inch (3 mm) and minus 0 inches (0 mm).
- B. Maximum Variation from Plane of Unit to Adjacent Unit: 1/32 inch (1 mm).
- C. Maximum Variation of Panel from Plane: 1/8 inch (3 mm).

### 3.5 CLEANING

- A. Clean work under provisions of General Requirements.
- B. Do not scratch or deface units.

### 3.6 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Maintain protective boards at exposed external corners. Provide protection without damaging completed work.

END OF SECTION





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## SECTION 04311

### CONCRETE MASONRY UNITS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Concrete masonry units.
- B. Flashing.
- C. Reinforcement, anchorage, and accessories.

##### 1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 05210 - Steel Joists and Joist Girders: Placement of steel bearing pads for joists.
- B. Section 05500 - Metal Fabrications: Placement of fabricated steel items.

##### 1.3 RELATED SECTIONS

- A. Section 04100 - Mortar and Masonry Grout: Mortar and grout.
- B. Section 07160 - Bituminous Dampproofing: Dampproofing masonry surfaces.
- C. Section 07212 - Board Insulation.
- D. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work.
- E. Section 07900 - Joint Sealers: Rod and sealant at control joints.

##### 1.4 REFERENCES

- A. ACI 530 - Building Code Requirements for Masonry Structures.
- B. ACI 530.1 - Specifications For Masonry Structures.
- C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

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- E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
  - F. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
  - G. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
  - H. ASTM B370 - Copper Sheet and Strip for Building Construction.
  - I. ASTM C55 - Concrete Building Brick.
  - J. ASTM C129 - Non-Load Bearing Concrete Masonry Units.
  - K. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
  - L. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
  - M. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
  - N. UL - Fire Resistance Directory.
- 1.5 SUBMITTALS: Submit under provisions of Division 1.
- A. Product Data: Provide data for masonry units and fabricated wire reinforcement.
  - B. Samples: Submit four samples of pre-faced masonry units to illustrate color, texture and extremes of color range.
  - C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- 1.6 QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 530 and ACI 530.1.
- 1.7 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.
- 1.8 REGULATORY REQUIREMENTS

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- A. Conform to 1994 Uniform Building code for UL Assembly No. requirements for fire rated masonry construction.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.
- D. Inspect concrete masonry units on site for damage.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## 1.11 COORDINATION

- A. Coordinate the masonry work with installation of window anchors.

## PART 2 PRODUCTS

## 2.1 CONCRETE MASONRY UNITS

- A. Hollow Non-Load Bearing Block Units (CMU): ASTM C129, Type I - Moisture Controlled; normal weight.
- B. Size and Shape: Nominal modular size of 8 x 8 x 16 inches. Provide special units for 90 degree corners, bond beams, lintels.

## 2.2 REINFORCEMENT AND ANCHORAGE

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- A. Single Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication, 3/16 inch side rods with 9 US gauge cross ties.
  - 1. Manufacturers:
    - a) Heckman Building Products, Inc.
    - b) Dur-O-Wal, Inc.
    - c) Hohman & Barnard, Inc.
- B. Column Anchors: wire tie welded to 5/16 x 5 inch x 9 gage minimum thick, adjustable, hot dip galvanized to ASTM A123 B2 uncoated steel finish.
  - 1. Manufacturers:
    - a) Heckman Building Products, Inc. Model 315-C & 318-B
    - b) Dur-O-Wal, Inc. Model D/A 207 & D/A 750
    - c) Hohman & Barnard, Inc. Model #359F & 302W
- C. Seismic/High Wind Loading Requirements
  - 1. Joint reinforcement truss type, steel wire, hot-dipped galvanized to ASTM A153 Class B2 (1.50 oz/ft<sup>2</sup>) after fabrication. Welded to the truss a double loop to hold the pintle which extends into the veneer to create a composite wall construction. Provide T s and corner sections for intersections of walls.
  - 2. Manufacturers:
    - a) Dur-O-Wal, Inc.: Seismic truss eye with 3/16 inch parallel wire and a 9 gauge Duro-O-Truss wire. Seismic pintle 12 ga. (0.105 in) welded to seismic truss at 16 inches o.c. which with the veneer pintle is tied to the seismic truss in the veneer.
    - b) Hohmann & Barnard, Inc. #180 - S.I.S., Double Loop-Lok Truss Seismicclip Interlock System. This system consist of the truss joint reinforcing with #180 Dulick Loop-Lok Truss, Loop-Lok Washer which holds the insulation in place; 3/16 inch dia. box Byna-tie, #187-A seismicclip and 9 ga continuous wire. All wire products shall be hot dip galvanized - ASTM A153 Class Bs (1.50 oz/ft.<sup>2</sup>).

## 2.3 MORTAR AND GROUT

- A. Mortar and Grout: As specified in Section 04100.

## 2.4 FLASHINGS

- A. Copper: ASTM B370, cold rolled; 20 oz/sq ft, 0.027 inch thick; natural finish.

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- B. Lap Sealant: Butyl type as specified in Section 07900.

## 2.10 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, heat fused joints.
1. Manufacturers:
    - a) Heckman Building Products, Inc.
    - b) Dur-O-Wall
    - c) Hohmann & Barnard, Inc.
- B. Joint Filler: Closed cell; oversized 50 percent to joint width; self-expanding; inch wide x by maximum lengths.
1. Manufacturers:
    - a) Heckman Building Products, Inc.
    - b) Dur-O-Wal
    - c) Hohmann & Barnard, Inc.
- C. Building Paper: No. 15 asphalt saturated felt.
- D. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.
- E. Weeps: Preformed plastic rectangular vents, 3/8 inch x 1- inch x 3-1/2 inch.
1. Manufacturers:
    - a) Heckman Building Products, Inc.
    - b) Dur-O-Wall
    - c) Hohmann & Barnard, Inc.
- F. Mortar Net: High density polyethylene, 1 inch (25.4 mm) thick, min 10 inches (250 mm) high.
1. Manufacturers:
    - a) Hohmann & Barnard, Inc.
    - b) Mortar Net USA, LTD.
    - c) Dur-O-Wall
- G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## PART 3 EXECUTION

## 3.1 EXAMINATION

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- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

## 3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

## 3.3 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.

## 3.4 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- C. Remove excess mortar as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean,

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unchipped edges. Prevent broken masonry unit corners or edges.

- G. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen dampproofing is applied.
- H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated on Drawings.
- I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### 3.5 REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce joint corners and intersections with strap anchors 16 inches oc.

### 3.6 MASONRY FLASHINGS

- A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls.
- B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry seal to concrete seal to sheathing over wood steel stud framed back-up.
- C. Lap end joints minimum 6 inches and seal watertight.
- D. Turn flashing, fold, and seal at corners, bends, and interruptions.

### 3.7 LINTELS

- A. Install steel lintels as scheduled.
- B. Install reinforced unit masonry lintels over openings where precast concrete lintels are

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not scheduled.

- C. Openings Up To 42 inches Wide: Place two, No. 3 reinforcing bars 1 inch from bottom web.
- D. Openings From 42 inches Up To 78 inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
- E. Openings Over 78 inches: Reinforce openings as detailed.
- F. Do not splice reinforcing bars.
- G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- H. Place and consolidate grout fill without displacing reinforcing.
- I. Allow masonry lintels to attain specified strength before removing temporary supports.
- J. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

### 3.8 GROUTED COMPONENTS

- A. See plans for bond beam and wall reinforcement.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

### 3.9 CONTROL JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.



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- C. Size control joint in accordance with Section 07900 for sealant performance.

## 3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door and frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
- B. Install built-in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build in organic materials subject to deterioration.

## 3.11 TOLERANCES

- A. Maximum Variation From Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9.1 m).
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

## 3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

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- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

## 3.13 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

## 3.14 PROTECTION OF FINISHED WORK

- A. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

## SECTION 04320

### veneer masonry system

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

1. Facebrick units.
2. Reinforcement, anchorage, and accessories.

##### 1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1. Section 05120 - Structural Steel: Placement of steel anchors for brick veneer reinforcement, including loose steel lintels, fabricated steel items, and steel angles.
2. Section 08520 - Aluminum Windows: Placement of window anchors in brick veneer.

##### 1.3 RELATED SECTIONS

1. Section 03300 - Cast-in-Place Concrete: Structural wall backing.
2. Section 04100 - Mortar and Masonry Grout: Mortar and grout.
3. Section 04311 - Concrete Masonry Units
4. Section 04340 - Reinforced Unit Masonry System
5. Section 05400 - Cold Formed Metal Framing: Structural wall backing.
6. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work and placement of reglets for flashings.
7. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.
8. Section 09260 - Gypsum Board Systems: Structural wall backing.

##### 1.4 REFERENCES

1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications For Masonry Structures.

3. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
4. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
5. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
6. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
7. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
8. ASTM B370 - Copper Sheet and Strip for Building Construction.
9. ASTM C55 - Concrete Building Brick.
10. ASTM C90 - Load-Bearing Concrete Masonry Units.
11. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
12. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
13. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
14. UL - Fire Resistance Directory.

1.5 SUBMITTALS: Submit under provisions of Division 1.

1. Product Data: Provide data for veneer masonry units and fabricated wire reinforcement.
2. Samples: Submit a brick panel (12 inch x 24 inch with brick face, mounted on plywood to illustrate color texture and extremes of color range
3. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

1. Perform Work in accordance with ACI 530 and ACI 530.1.
2. Maintain one copy copies of each document on site.

## 1.7 QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.8 REGULATORY REQUIREMENTS

1. Conform to applicable UL Design Assemblies, as indicated for fire rated masonry construction.

## 1.9 MOCKUP

1. Construct a masonry wall into a panel sized 8 feet long by 6 feet high, which includes mortar and accessories, concrete masonry unit backup, joint reinforcing, control joints, wall openings, flashings, wall insulation, and typical foundation condition.
2. Locate where directed.
3. Mockup may not remain as part of the Work.

## 1.10 PRE-INSTALLATION CONFERENCE

1. Convene one week prior to commencing work of this Section.

## 1.11 DELIVERY, STORAGE, AND HANDLING

1. Materials shall be delivered to the site in a undamaged condition and stored out of contact with the ground in a manner to avoid chipping and breakage.

## 1.12 ENVIRONMENTAL REQUIREMENTS

1. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
2. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## 1.13 COORDINATION

1. Coordinate the masonry work with brick veneer, and installation of window anchors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS - BRICK UNITS - Equal in color & appearance to

1. Mutual Materials Co. 6721 E Trent Ave, Ste. A Spokane, WA 99212. Phone 509-922-4100. OXFORD Mission textured, Architectural Face Brick.

### 2.2 BRICK UNITS

1. Face Brick: ASTM C216, Type FBS, Grade SW; OXFORD Architectural Face Brick.
2. Hollow Facing and Building Brick: ASTM C652, Grade SW, Type HBS.
3. Size and Shape: Nominal modular size of 3-5/8 x 2-1/4 x 7-5/8 inches. Provide special units for 90 degree corners, and lintels.

### 2.3 REINFORCEMENT AND ANCHORAGE

1. See Section 04255 - for anchorage and reinforcement with steel stud back up.
2. See Section 04311 - Concrete Masonry Unit for reinforcement and anchorage requirements of seismic and non-seismic conditions.

### 2.4 MORTAR AND GROUT

1. Mortar and Grout: As specified in Section 04100.

### 2.5 FLASHINGS

1. Flashing: as specified in Section 04311 and 04320.

### 2.6 ACCESSORIES

1. Preformed Control Joints: Closed cell neoprene sponge material. Provide with corner and tee accessories, heat fused joints.
  1. Manufacturers:
    1. Dur-O-Wall
    2. Hohmann & Barnard, Inc.
2. Joint Filler: Closed cell polyethylene; oversized 50 percent to joint width; self-expanding; 3/4 inch wide x by maximum lengths.

3. Wall Filter:
  1. PEC-MAT as manufactured by Greenstreak, Inc., 3400 Tree Court Ind. Blvd., St. Louis, MO
  2. MIRMAT - Series 2400 as manufactured by Mirafi, Inc., Charlotte, N.C.
4. Weeps: Preformed plastic rectangular vents, 3/8 inch x 1-1/2 inch x 3-1/2 inch.
  1. Manufacturers:
    1. Dur-O-Wal
    2. Hohmann & Barnard, Inc.
    3. Heckman Industries, Inc.
5. Mortar Net: High density polyethylene, 1 inch (25.4 mm) thick 10 inch (250 mm) high.
  1. Manufacturer
    - a) Hohmann & Barnard, Inc.
    - b) Mortar Net USA, LTD.
    - c) Dur-O-Wall
6. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

1. Verify that field conditions are acceptable and are ready to receive work.
2. Verify items provided by other sections of work are properly sized and located.

#### 3.2 PREPARATION

1. Direct and coordinate placement of metal anchors supplied to other sections.
2. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

#### 3.3 COURSING

1. Establish lines, levels, and coursing indicated. Protect from displacement.
2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
3. Brick Units:
  1. Bond: Running.

2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

#### 3.4 PLACING AND BONDING

1. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as Work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Isolate top joint of masonry walls from horizontal structural framing members and slabs or decks with compressible joint filler.

#### 3.5 WEEPS

1. Install weeps in veneer at 24 inches (600 mm) oc horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls and at top of walls.

#### 3.6 CAVITY BEHIND VENEER

1. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.
2. Build outer wythe to permit installation of cavity insulation.

#### 3.7 REINFORCEMENT AND ANCHORAGE

1. Install horizontal joint reinforcement 16 inches (400 mm) oc.
2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.



3. Place joint reinforcement continuous in first and second joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches (150 mm).
5. Embed wall ties in masonry back-up for bonding veneer at maximum 16 inches (400 mm) oc vertically and 16 inches (400 mm) oc horizontally. Place at maximum 3 inches (75 mm) oc each way around perimeter of openings, within 12 inches (300 mm) of openings

### 3.8 MASONRY FLASHINGS

1. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls.
2. Turn flashing up minimum 8 inches (200 mm) and bed into mortar joint of masonry seal to concrete back-up.
3. Lap end joints minimum 6 inches (150 mm) and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.

### 3.9 LINTELS

1. Install loose steel lintels over openings.
2. Maintain minimum 8 inch (200 mm) bearing on each side of opening.

### 3.10 CONTROL JOINTS

1. Do not continue horizontal joint reinforcement through control joints.
2. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
3. Size control joint in accordance with Section 07900 for sealant performance.

### 3.11 TOLERANCES

1. Maximum Variation From Unit to Adjacent Unit: 1/32 inch (1.5 mm).
2. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
3. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

4. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
5. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft (3 mm/m).

### 3.12 CUTTING AND FITTING

1. Cut and fit for conduit, sleeves, and recessed items. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.13 CLEANING

1. Remove excess mortar and mortar smears.
2. Replace defective mortar. Match adjacent work.
3. Clean soiled surfaces with cleaning solution.
4. Use non-metallic tools in cleaning operations.

### 3.14 PROTECTION OF FINISHED WORK

1. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

## SECTION 04340

### REINFORCED UNIT MASONRY SYSTEM

This section includes engineered, steel reinforced, structural and/or load bearing masonry, usually with high slump grout or concrete filled cores, cavities, and horizontal bond beams and lintels.

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Concrete masonry units.
2. Joint reinforcement, anchorage, and accessories.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Section 05120 - Structural Steel: Special anchors for attachment to structural steel.

##### 1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1. Section 05120 - Structural Steel: Placement of steel anchors.
2. Section 05210 - Steel Joists and Joist Girders: Placement of steel bearing pads for joists.
3. Section 05500 - Metal Fabrications: Placement of loose steel lintels and fabricated steel items.
4. Section 07620 - Sheet Metal Flashing and Trim: Placement of reglets for flashings.
5. Section 08112 - Structural Steel Frames: Placement of window and door anchors.

##### 1.4 RELATED SECTIONS

1. Division 1 - Quality Control and Testing Laboratory Services.
2. Section 04100 - Mortar and Masonry Grout: Mortar and grout.
3. Section 05500 - Metal Fabrications: Loose steel lintels and fabricated steel items.
4. Section 07160 - Bituminous Dampproofing: Dampproofing masonry surfaces.
5. Section 07620 - Sheet Metal Flashing and Trim: Cap flashings over masonry work and placement of reglets for flashings.

6. Section 07900 - Joint Sealers: Rod and sealant at control and expansion joints.

## 1.5 REFERENCES

ACI SP-66	ACI Detailing Manual
ACI 530	Building Code Requirements for Masonry Structures
ACI 530.1	Specifications For Masonry Structures (including Specified References, Para. 1.3.)
ASTM A82	Cold-Drawn Steel Wire for Concrete Reinforcement
ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate
ASTM A525	Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C55	Concrete Building Brick
ASTM C90	Load-Bearing Concrete Masonry Units
IMIAC	International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction
UL	Fire Resistance Directory

## 1.6 SUBMITTALS: Submit under provisions of Division 1.

1. Shop Drawings: Indicate bars sizes, spacings, locations, reinforcement quantities, bending and cutting schedules, supporting and spacing devices for reinforcement, accessories.
2. Product Data: Provide data for masonry units and fabricated wire reinforcement.
3. Samples: Submit four samples of units to illustrate color, texture and extremes of color range.
4. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

## 1.7 QUALITY ASSURANCE

1. Perform Work in accordance with applicable provisions in ACI 530 and ACI 530.1.
2. Maintain one copy of each document on site.

## 1.8 REGULATORY REQUIREMENTS

1. Conform to 1994 Uniform Building code for UL Assembly requirements for fire rated masonry construction.

## 1.9 PRE-INSTALLATION CONFERENCE

1. Convene one week prior to commencing work of this section, under provisions of Division 1.

## 1.10 DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site under provisions of Division 1.
2. Accept glazed pre-faced units on site. Inspect for damage.

## 1.11 ENVIRONMENTAL REQUIREMENTS

1. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
2. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## 1.12 COORDINATION

1. Coordinate the masonry work with masonry veneer and installation of window and door anchors.

# PART 2 PRODUCTS

## 1.13 CONCRETE MASONRY UNITS (See Section 04311)

## 1.14 REINFORCEMENT AND ANCHORAGE

1. Joint reinforcement: See Section 04311, under Seismic/High Wind Loading Requirements .
2. Reinforcing Steel: ASTM A615 type.

#### 1.15 MORTAR AND GROUT

1. Mortar and Grout: As specified in Section 04100.

#### 1.16 ACCESSORIES (See Section 04311)

### PART 3 EXECUTION (See Section 04311 except as follows)

#### 1.17 EXAMINATION

1. Verify that field conditions are acceptable and are ready to receive work.

#### 1.18 PLACING AND BONDING

1. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as Work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or bitumen dampproofing is applied.
9. Isolate masonry partitions from vertical structural framing members with a control joint as indicated on plans.
10. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

#### 1.19 REINFORCEMENT AND ANCHORAGE

1. Install horizontal joint reinforcement 16 inches (400 mm) oc.

2. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
3. Place joint reinforcement continuous in first joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches (150 mm).
5. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
6. Embed anchors embedded in concrete or attached to structural steel members. Embed anchorages in every second block joint.
7. Reinforce joint corners and intersections with strap anchors 16 inches (400 mm) oc.

#### 1.20 GROUTED COMPONENTS

1. Reinforce bond beam, pilasters and CMU cells, and grout as shown on drawings.
2. Lap splices minimum 24 bar diameters.
3. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
4. Place and consolidate grout fill without displacing reinforcing.
5. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

#### 1.21 ENGINEERED MASONRY

1. Lay masonry units with core cells vertically aligned and clear of mortar and unobstructed.
2. Place mortar in masonry unit bed joints back 1/4 inch (6 mm) from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before placing grout.
3. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated.
4. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters.
5. Wet masonry unit surfaces in contact with grout just prior to grout placement.

6. Grout spaces less than 2 inches (50 mm) in width with Fine grout using low lift grouting techniques. Grout spaces 2 inches (50 mm) or greater in width with Course grout using high or low lift grouting techniques.
7. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch (38 mm) below top of upper masonry unit to form a positive key for subsequent grout placement.
8. Grouting: (conform to ACI 530.1 Section 4)

END OF SECTION



## SECTION 05120

### STRUCTURAL STEEL

#### PART 1 - GENERAL

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness and detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings shall be considered simple shear connections and shall be designed and detailed in accordance with AISC M016, AISC M015L, and pertinent provisions of AISC S338L. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Office. The AISC S335, AISC S328L with pertinent provisions of AISC S331L shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC S329 & AISC S334L.

#### 1.1 SCOPE OF WORK

1. Furnishing of and paying for all labor, materials, services, appliances, and equipment necessary for the execution, installation, and completion of all work specified herein.
2. Work included:
  1. Fabrication and erection of all structural steel as defined in Section 2.1 of the AISC Code of Standard Practice for steel buildings and bridges and as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
    1. All structural steel rolled sections such as beams, girders, trusses, columns, purlins, channels, angles, anchor plates, bearing plates, brackets, braces, loose lintels, shelf angles, anchor bolts, sleeves, bearing plates, inserts, and/or other steel items incidental to construction as shown on the Structural (S) Drawings or as normally required to complete the erection and support of all structural steel work specified herein.
    2. All connections, erection fittings, and devices required to complete this work.
    3. Shop painting and field touch-up painting as noted on drawings.
    4. Steel shear studs for composite beam construction as noted on drawings if shop attached.

5. All miscellaneous steel angles, beams, rods, and braces to be furnished and/or installed for support or bracing of door frames, operable walls, and/or any other members as and where shown on the drawings.

## 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Section 03300 - Anchorages cast in concrete
2. Section 04200 - Anchorages embedded in masonry
3. Loose lintels, shelf angles, anchor bolts, sleeves, bearing plates, inserts, wedge inserts, expansion joint plates, and other incidental metal items of structural and/or miscellaneous steel as and where shown on the drawings and/or as required to be built into concrete or masonry shall be provided as indicated or specified in Section 05500. At the proper time these shall be furnished to the respective contractor, where applicable, including instructions or templates for their installation within masonry and/or concrete construction.
4. All miscellaneous steel members supporting penetrations of roof deck whether or not same is shown on the drawings.

## 1.3 RELATED SECTIONS

1. Shop Drawings, Product Data, and Samples: General Conditions, Division 1.
2. Testing Laboratory Services: General Conditions, Division 1 Quality Control
3. Section 03300 - Cast-In-Place Concrete Including Grouting of Baseplates and Bearing Plates
4. Section 04200 - Unit Masonry System Including Anchor Bolts Cast in Masonry
5. Section 04255 - Nonbearing Masonry Veneer/Steel Stud Walls
6. Section 04320 - Veneer Masonry Systems
7. Section 05210 - Steel Joists and Joist Girders.
8. Section 05311 - Steel Roof Deck Including Support Framing for Small Openings: Roof Deck.
9. Section 05400 - Cold Formed Metal Framing
10. Section 05500 - Metal Fabrications, Non-framing steel fabrications affecting structural steel work.

11. Section 06100 - Miscellaneous Steel Members within Millwork Construction
12. Section 09900 - Painting

#### 1.4 RELATED DOCUMENTS

1. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 - "General Requirements" apply to work of this section.
2. Use this specification in conjunction with the General Notes and specific directives on the Contract Structural Drawings.
3. Perform work in accordance with the AISC Specifications and Code of Standard Practice except as modified herein.

#### 1.5 REFERENCES

The publications listed below form a part of this spec. to the extent referenced. The pubs are referenced to in the text by basic designation only.

1. American Institute of Steel Construction (AISC)
  1. M016 "Manual of Steel Construction Allowable Stress Design".
    1. S335 "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design", with "Commentary"
    2. S329 "Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts"
    3. S336 "Specification for Allowable Stress Design of Single-Angle Members", with "Commentary"
  2. M015L "Manual of Steel Construction - Load and Resistance Factor Design," 1993
    - a. S328L "Specification for Structural Steel Buildings, Load and Resistance Factor Design" (LRFD)
    - b. S334L "Load and Resistance Factor Design, Specification for Structural Joints Using ASTM A325 or A490 Bolts"
    - c. S331L - Guide to LRFD
    - d. S338L - Load & Resistance Factor Design of Simple Shear Connections
  3. S303 "Code of Standard Practice for Steel Buildings and Bridges"

4. S341 "Seismic Provisions for Structural Steel Bldgs," 1992
5. M013 "Detailing for Steel Construction"
6. S323 "Quality Criteria and Inspection Standards"
2. American Institute for Hollow Structural Sections-Structural Steel Tubing; HSS, 929 McLaughlin Run Road Suite 8 Pittsburgh, PA 15017.
3. American Society of Mechanical Engineers (ASME)
  1. ASME B18.21.1 - 1990 Lock Washers
  2. ASME B46.1-1985 Surface Texture (Surface Roughness, Waviness & Lay)
4. American Welding Society (AWS):
  1. "Structural Welding Code" (AWS D1.1-90) including the "Standard Qualification Procedure", Section 5. qualifications, Part B, Procedure Qualification.
  2. "Guide for the Non-destructive Inspection of Welds" (ANSI/AWS B1.10-86).
  3. Guide to "Standard for Qualification and Certification of Welding Inspectors" (AWS-QC1-86).
  4. Welding Inspection (AWS 2nd Edition, WI-80).
  5. "Symbols for Welding, Brazing & Nondestructive Examinations, AWS A2.4 (1986).
5. Research Council on Structural Connections of the Engineering Foundation:
  1. Specifications for Structural Joints Using ASTM A325 or A490 Bolts
6. American Society for Testing and Materials (ASTM):
  1. ASTM A6-90 Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use"
  2. See Materials Specifications listed under Part 2 - PRODUCTS
7. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual": Vol. 1, Good Painting Practice and Vol. 2, Systems and Specifications. (AISC P604 and P603)
8. Industrial Fasteners Institute (IFI): Handbook for Bolt, Nut, and Rivet Standards.

9. American Society for Non-Destructive Testing (ASNT), Recommended Practice SNT-TC-1A.
  10. American Council of Independent Laboratories Inc. (ACIL) "Manual of Practice".
    1. Quality Control System, Requirements for a Testing and Inspection Laboratory.
    2. Scope of Services, Materials, Engineering Testing and Inspections.
  11. Alterations of Contractual Relationship: No provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of CONTRACTING OFFICER, CONTRACTOR, or ENGINEER, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER, or any other authority to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility contrary to the provisions of these Contract Documents.
- 1.6 SUBMITTALS: Submit under provisions of Specifications Division 1.
- Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required. Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.
1. Shop Drawings: Shop and Erection Drawings, as defined in Specification Division 1 and specified in AISC (S303) Code, Section 4, and AISC Specifications, Section 1.1 clearly indicating profiles, sizes, spacing, and locations of structural members, connections, attachments, anchorages, framed openings larger than 18" square, size and type of fasteners, cambers, shop painting, and all other details required for the fabrication and erection of the structural steel. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be furnished and installed for work in other sections. Drawings shall clearly distinguish between shop and field welds and bolts and shall clearly identify type of high-strength bolted connection (snug-tight or fully-tightened bearing, or slip-critical).
  2. Welding Procedure: Indicate welded connections with AWS A2.4 welding symbols; indicate net weld size and lengths. Submit written description required to illustrate each welding procedure to be performed. Submit descriptive data for field welding equipment including type, voltage, and amperage.
  3. Mill Test Reports: Submit under provisions of Specifications Division 1, indicating structural strength, destructive and non-destructive test analysis.

4. Manufacturer's Mill Certificate: Submit under provisions of Specification Division 1 Manufacturer's Certificates, certifying that the materials meet or exceed specified requirements.
5. Welder's Certificates: Submit certificates certifying welders employed on the work meet AWS qualifications within the previous 12 months.
6. Surveys: Prepare and submit showing elevations and locations of base plates and/or anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between installation and contract documents.
7. Proofs of compliance for materials: Submit for approval the following:
  1. Reports of ladle analysis for all steels.
  2. Reports of tensile properties and bend tests for steel shapes, bars, and plates.
  3. Certified Mill Test Reports required by applicable ASTM Material Specifications (AISC Code-S303, Div. 5). See AISC-S303 Code of Standard Practice, Section 6.1, Identification of Material.
  4. Submit Certificates of Conformance for:
    1. Structural steel tubing.
    2. Shear studs in accordance with AWS D1.1, Chapter 7.
    3. Filler material for welding.
  5. Reports of mechanical properties of headed stud type shear connectors.
  6. Reports of mechanical tests for high-strength threaded fasteners.
8. Manufacturer's literature: Submit description of each type of welding stud and arc shield.
9. Inspection reports: Submit reports for the inspection and tests specified in 1.7 below.
10. Certification of Quality Assurance Program: (See 1.7)

#### 1.7 QUALITY CONTROL AND ASSURANCE

1. General Requirements: Conform to general requirements for Quality Control and Assurance covered in Division 1 and specific requirements as outlined in the following AISC documents:

1. "Code of Standard Practice for Steel Buildings and Bridges", AISC-S303, Section 8 - Quality Control.
2. "Specifications for Steel Buildings, with Commentary, AISC-ASD Manual, AISC-S335, Ch. M, Fabrications, Erection and Quality Control, LRFD Spec., Ch. M, including "Commentary" and supplements thereto as issued.
2. Quality Control Criteria: The Quality Criteria and Inspection Standards for the preparation of materials, fitting and fastening, dimensional tolerances, surface preparation and painting, non-destructive examination and special fabrication problems shall conform to the AISC recommendations contained in Publication "Quality Criteria and Inspection Standards" (S323). Mill material camber, flatness, straightness, sweep, and cross section are established by ASTM A6. The Fabricator is allowed to use controlled heating, mechanical straightening, or a combination of both methods, consistent with the manufacturer's recommendations, to adjust for conformance.
3. Quality Assurance: Both the Fabricator and Erector shall maintain a Quality Assurance program conforming to AISC-S303 Code of Standard Practice, Section 8, and AISC Specification for Structure Steel Buildings, Section M5, to assure that all of the work is performed in accordance with this contract document. It shall be the responsibility of the Contractor to maintain control of the quality of the materials and workmanship, and conformance to the project Specifications. Materials and fabrication procedures are subject to inspections and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
4. Material Certification: The Fabricator shall provide an affidavit stating that the structural steel furnished meets the requirement's of this specification. Certified mill test reports or certified reports of tests made by the Fabricator or a testing laboratory in accordance with ASTM A6 or A568, as applicable, shall constitute sufficient evidence of conformity with the above standards if the identity of these materials are properly maintained.
5. Identification: When the structural steel is furnished to be a specified minimum yield point greater than 36 ksi, the ASTM specification number or other specifications designation shall be indicated by the mill near one end of each structural shape or plate, such specification designation may be applied to the top piece of each bundle or lift, or the bundle or lift may be tagged. After fabrication, each piece shall be marked in the Fabricator's plant by painting the ASTM or other specification designation on the piece, over any shop coat of paint, prior to shipment from the Fabricator's plant. Pieces of such steel which are to be cut to smaller sizes shall, before cutting, be legibly marked with the Fabricator's identification mark on each of the smaller pieces to provide continuity of identification.

6. Welding (Shop and Field): Fabrication/erection inspection and testing of weldments shall be provided by the Contractor in accordance with AWS D1.1, Section 6. The fabrication/ erection inspector(s) shall be AWS Certified Welding Inspector(s) in accordance with the provisions of AWS QCI, Standard for Qualifications and Certification of Welding Inspectors. Provide certification that welding inspectors, welders, welding operators, and tack welders to be employed in work have satisfactorily passed AWS qualification tests within previous twelve (12) months prior to starting the work. If recertification of welders is required, it will be Contractor's responsibility to assure compliance. Each welder working on the project shall mark his identification symbol at each weldment completed whether in shop or field.
7. High-Strength Bolts: Installation shall conform to AISC, Specification for Structural Joints using ASTM A325 and A490. Each member of bolting crew applying high - strength bolts shall be assigned an identifications mark or symbol which he shall apply to each joint worked. The Contractor shall verify that all contact surfaces in slip critical (friction-type) connections conform to the applicable requirements, and that all bolts have been appropriately installed and tightened.

#### 1.8 QUALIFICATIONS

1. The structural steel fabricating plant and the steel erector shall have the personnel, organization, experience, procedures, knowledge, equipment, capacity, and commitment to produce and erect fabricated steel of the structural steel work involved in this project.
  1. The Fabricator shall have specialized in performing the work of this section with a minimum of 2 years documented experience.
  2. The Erector shall have specialized in performing the work of this section with minimum 2 years documented experience.
  3. Fabricator shall be certified under the AISC "Quality Certification Program" or equivalent verification for the following category:
    - I. Conventional Steel Structures

#### 1.9 VERIFICATION TESTING AND INSPECTION: Provide Testing and Inspection services conforming with the requirements of the Contract Documents as provided is Specification Division 1. These services will consist of the following:

1. Independent Testing and Inspection Agency (Materials Engineering Laboratory) qualified to perform the following services:
  1. Review the pertinent Construction Documents and included reference standards.
  2. Inspect, test, and/or verify the following in accordance with ACIL Manual of Practice, Scope of Services, Section VI.



1. Mill Materials: ASTM Specification and grade, camber, flatness, straightness, sweep, cross section, surface and edge condition, surface preparation and soundness.
  2. Fabricated Material: Traceability and identification of special strength or proper material, edge roughness, straightness, curving and cambering, fitting and fastening, welding, painting, handling, and storage.
  3. Erection: Dimensional tolerances, field bolting and welding, non-destructive examination where specified, damaged or distorted material, laminations and lamellar tearing, base plates and bearings.
  4. Corrections: Review corrections.
3. Reports: Report discrepancies immediately; periodic reports weekly.
4. Maintain Identity: Test requirements for materials as specified herein or incorporated in referenced documents may be waived provided certified copies of mill test or test reports from approved laboratories performed on previously manufactured materials are submitted and approved. Test reports shall be accompanied by notarized certificates from the Manufacturer certifying that the tested material was of the same type, quality, and manufacture as that being supplied for this project. Test shall have been conducted not more than one year prior to the date such materials are submitted for approval. Proper identification of all high-strength or special steels shall be maintained throughout the fabrication process.
5. Inspection of Shop and Field Welds: Inspection of shop welds shall be in accordance with Section 6 and 8.15 of AWS Structural Welding Code and as follows:
1. Visual inspection of all shop welds in accordance with AWS D1.1, 6.5.
  2. A representative sample of full penetration welds and all questionable quality full penetration welds shall be non-destructive tested by one of the following as appropriate:
    - (1) Liquid penetrant inspection of the shop welds in accordance with AWS D1.1, 6.5 (ASTM-E165)
    - (2) Magnetic particle inspection of the shop welds in accordance with AWS D1.1, 6.7.5 (ASTM-E105)
    - (3) Radiographic inspection of the shop welds in accordance with AWS D1.1, Part B, Chapter 6 - Inspection (ASTM E94 and E99)
    - (4) Ultrasonic inspection of the shop welds indicated in accordance with AWS D1.1, Part C, Chapter 6 - Inspection (ASTM E164).
  3. Stud welding inspection of shop-welded studs in accordance with AWS D1.1, 7.8.

6. Inspection of shop painting:

1. Surface preparation prior to painting shall be visually evaluated for degree of cleaning by comparison with SSPC pictorial standards.
2. Measurement of dry film thickness of each coat of shop-applied paint shall be in accordance with ASTM D1005-72.

7. Erection verification inspection and testing:

1. Verification of qualifications of field procedures and personnel.
2. Inspection of erected structural steel work for conformance with the requirements specified.
3. Inspection of field-assembled high-strength bolted construction shall be in accordance with AISC Specification for Structural Joints, Section 6, using ASTM A325 or A490 bolts.
4. Inspection of field welds shall be in accordance with AWS Structural Welding Code, Section 6.
5. Perform non-destructive testing as appropriate for all field welds of questionable quality (or replace weld) and test 10% of all full penetration field welds.
6. The Fabricator and Erector shall receive copies of all inspection reports.

2. The Contractor shall correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work and as may be necessary to show compliance of corrected work.

1.10 PRODUCT HANDLING

1. Delivery of materials to be installed under other sections:

1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.

2. Storage of materials:

1. Structural steel members which are stored at the project site shall be above ground on platforms, skids, or other supports.

2. Steel shall be protected from corrosion.
3. Other materials shall be stored in a weathertight and dry place until ready for use in the work.
4. Packaged materials shall be stored in their original, unbroken packages or containers.

#### 1.11 RESPONSIBILITIES

1. The Contractor/Fabricator is responsible for properly implementing the design drawings, properly furnishing materials and workmanship, maintaining the specified fabrications and erection tolerances, and for fit and erectability of the structure. The project A/E is not responsible for reviewing the means and methods of construction or related job safety issues, which are the Contractor's responsibility.
2. AISC-S303 Code, paragraph 1.5.1. Where connections are not shown on drawings, the connections shall be in accordance with the requirements of the AISC Specifications Sections 1.15 Connections. Where reactions are shown on drawings, connections shall be designed to accommodate these forces, under the supervision of a Professional Structural Engineer experienced in the design of this work, and subject to review and approval by the Structural Engineer.
3. Substitutions of member sizes due to non-availability of materials shall be of equivalent strength and rigidity to that specified, shall be compatible with the design and shall be approved by the Structural Engineer of Record after being specifically called to his attention in writing.

- 1.12 FIELD MEASUREMENTS: Verify that field measurements are as shown on drawings or as approved on shop drawings.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND COMPONENTS

1. Refer to AISC Specifications, Section 1.4 LRFD Spec. Section A3 - Materials: See Structural Drawings and General Notes for specific requirements, unless modified or specified hereafter.
2. Structural Steel: ASTM A36 or as specified on drawings. See AISC Specifications, Section 1.4.1 Structural Steel for other grades of steel shown on drawings. Structural Tubing: ASTM A500, Grade B. Pipe: ASTM A53, Grade B.
3. Bolts: AISC Specifications, Section 1.4.4 Bolts

1. Unfinished Bolts: ASTM A307
2. High-Strength Steel Bolts: ASTM A 325.
3. Anchor Bolts and Nuts: ASTM A307, Grade A
4. Rivets: AISC Specifications, Section 1.4.3
  1. Steel structural rivets: ASTM A502.
5. Filler metal and flux for welding: AISC Specifications, Section 1.4.5.
  1. AWS A5.1, E60 or E70 unless otherwise approved. Electrodes shall be compatible with the base material being welded. Manufacturer's certification shall constitute evidence of conformance.
6. Sliding Bearing Plates: Teflon coated
7. Stud shear connectors: AISC Specifications, Section 1.4.6
  1. ASTM A108-81 Grade 1010-1020 cold-drawn bar stock, conform to AWS D1.1, Chapter 7.
  2. Manufacturer's certification constitutes evidence of conformity with the Code.
8. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, compressive strength: 7000 psi at 28 days. See Section 03300. Coordinate with Section 03300 CIP concrete.
9. Wedge inserts: This section is to furnish male portion of all wedge inserts to be inserted within female section of inserts furnished by Section 03300 for support of steel members specified herein. Furnish all shims as required for alignment of all members.
10. Shop paint primer: AISC Code of Standard Practice, Section 6.5, AISC Spec. Section 1.24 and AISC-SSPC 3rd Edition 1983 "Systems and Specs." Paint shall conform to SSPC Paint 25
  1. Dry interior where steel is embedded in concrete, encased in masonry, or protected by membrane ~~or contact type fireproofing~~ leave unpainted. ~~In coastal regions:- #1-5773 Zinc Chromate Primer, Southern Coatings, Inc. or equivalent primer having been successfully tested for bond adhesion with the fireproofing material and acceptable to the fireproofing manufacturer.~~
  2. Interiors permanently exposed to view, normally dry - SSPC-PS 7.00-82 One-Coat Shop Paint System (SSPC Paint 13) (Fed. Spec. TT-P-636).

3. Three coat vinyl painting with a wash primer and vinyl alkyd finish coat (for atmospheric exposure) SSPS-Paint 27. or 1.03 - 64T Oil Base Paint System (SSPC Paint 14).
4. Except for contact surfaces, surfaces inaccessible after shop assembly shall be cleaned and painted prior to assembly.
5. Surfaces within 2 inches of any weld location shall be free of materials that would prevent proper welding or produce toxic fumes during welding.
6. Paint is permitted in bearing type connections.
7. For slip-critical connections where the design is based on special laying surface conditions, shop contact surfaces shall be cleaned prior to assembly in accordance with the provisions of the AISC Code, but shall not be painted. Field contact surfaces shall be shop cleaned.
8. Touch up Primer for Galvanized Surfaces: Zinc Rich type.
9. For steel exposed architecturally and/or to be field painted, the shop primer shall be compatible with the finishing material.
11. Other materials shall conform to the applicable current specifications of the ASTM.

## 2.2 FABRICATION AND DELIVERY

1. Conform to AISC-S303 Code of Standard Practice, Section 6 and AISC Specifications, Section 1.23.
2. Shop fabrication and assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with approved shop drawings. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials. Verify all dimensions prior to fabrication.
3. Dimensional and straightness tolerances: Conform to AISC Code, Section 6.4 and ASTM A6 for compression joints requiring milled ends.
4. Provide openings in structural members for other building components as shown on drawings. Locate holes so as not to cause any appreciable reduction in strength of members and reinforce openings with steel plates and/or angles sized and welded in place to restore members to original strength as approved by the Engineer.

5. All openings through steel floor or roof deck square are to receive supplemental steel framing. See plans or deck specification.
6. Cut and mill column ends and bearing plates accurately to assure full contact of bearing surfaces prior to welding.
7. Camber: Horizontal members to accommodate dead-plus live load deflections as indicated on the contract drawings. See General Notes on Structural Drawings, AISC Specifications, Section 1.19 and AISC Code, paragraph 6.4.4. Camber for composite beams and girders. See structural plans.
8. Clean, prepare, and shop prime structural steel members. Do not prime surfaces to be field-welded or to be bolted or in contact with concrete or fireproofing.
9. Shop and field connections shall be riveted, bolted, welded, or a combination of these as required to conform to AISC Specifications.  
Field connections:
  1. Bolted in accordance with AISC Specifications except where welded connections are required or selected.
  2. High-strength threaded fasteners shall be used for bolted connections except where standard threaded fasteners are permitted.
  3. Welded connections shall conform to AWS D1.1. Non-destructive testing will be required on 10% of all full-penetration welds. Welding materials shall be of the type required for materials being welded and conforming to applicable AWS Specifications.
10. Bearing plates:
  1. Bearing plates shall be provided under beams, closures, and girders resting on footings, piers, and walls as shown on the drawings with anchorage devices.
  2. Bearing plates shall be either attached or loose as required for erection.
11. Metal framing appearance of exposed items:
  1. Form members to Manufacturer's standard shapes meeting design criteria.
  2. Cut right angle connections of framing components to fit squarely against abutting members as shown on drawings. Weld or bolt as shown.
  3. Grind smooth all welds and holes cut in structural members exposed to view after fabricating.

4. All items are to be square, straight, and true to detail in all respects.
5. Fabricate all items as shown on drawings and specified herein. All must present smooth surface.

## PART 3 - EXECUTION

### 3.1 INSPECTION

1. Erector shall examine areas and conditions under which structural steel work is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work.
2. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

### 3.2 ERECTION

1. Erector shall check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds and report discrepancies to Contracting Officer.
2. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Contracting Officer.
3. Erect structural steel in accordance with the drawings and as provided in AISC Code, Section 7 and AISC Specs., Section 1.25, except as hereinafter specified.
4. Field assembly:
  1. Steel frames and/or members shall be assembled accurately to the lines and elevations indicated and within the erection tolerances specified in AISC Code, Section 7.11.
  2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
  3. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.
  4. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
  5. Splices shall be permitted only where indicated or approved in writing.

5. Bearing plates:
  1. Bearing plates for columns, beams, and similar structural members shall be aligned with wedges or shims before grouting.
6. Make adequate provisions for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of necessary permanent bracing.
7. Do not field-cut or alter structural members without the written approval of the Contracting Officer.
8. Temporary shoring and bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
9. Temporary planking: Provide temporary planking and working platforms as necessary to complete work effectively.
10. Anchor bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
  1. Refer to Sections 03300 and 04200 of these specifications for anchor bolt installation in concrete and for masonry installations.
11. Setting baseplates and bearing plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of baseplates and bearing plates. Set loose and attached baseplates and bearing plates for structural members on wedges or other adjusting devices.
12. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of baseplate or bearing plate prior to packing with grout.
13. Splice members only where indicated and accepted on approved shop drawings unless specifically approved in writing.
14. Erection Bolts: On exposed, welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.



15. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Do not enlarge holes in members by burning or by use of drift pins except in secondary bracing members. Ream holes which must be enlarged to admit bolts.
16. Gas cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.

### 3.3 TOLERANCES

1. Comply with Frame Tolerances, Section 7.11, AISC Code of Standard Practice and Correction of Errors, Section 7.12.
2. Maximum variation from plumb; 1/4 inch per story, non-cumulative.
3. Maximum offset from true alignment; 1/4 inch.

### 3.4 PROTECTION

1. Do not use structural units for storage or working platforms until permanently secured in position.
2. Assure that construction loads do not exceed carrying capacity of structure.

### 3.5 FIELD PAINTING TOUCH-UP

1. After the erection of all structural and miscellaneous steel members, touch-up paint all abrasions and unpainted areas with the same paint used for the shop painting.
2. All shelf angles and lintels which will have any part exposed to weather after completion of work will receive prior to erection one finish paint coat by Section 09900 - Painting.

### 3.6 CLEAN-UP

1. Remove from the work site all debris caused by this sub-contract.

END OF SECTION

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## SECTION 05210

### STEEL JOISTS AND JOIST GIRDERS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

1. Furnishing of and paying for all labor, materials, services, appliances, and equipment necessary for the execution, installation, and completion of all work specified herein.
2. Scope of work: Extent of work is shown on the drawings, including basic layout and type of joists required. Unless otherwise specified, the following items are included: Steel joists, joist girders, joist extended ends, ceiling extensions, extended bottom chords used as struts, bridging and bridging anchors, joist girder bottom chord bracing, joist wall and beam anchors, headers (which are defined as a member supported by and carrying open-web steel joists), loose bearing plates, and anchor bolts for site placement. Provide design for special loads or special joists noted on plans.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Section 03300 - Anchorages Cast in Concrete
2. Section 04200 - Anchorages Embedded in Masonry

##### 1.3 RELATED SECTIONS

1. Division 1 - Submittals and Quality Assurance
2. Section 03300 - CIP Concrete Grouting Base Plates and Bearing Plates, Concrete Slabs, Reinforcement in Slabs over Joists, Steel Centering, and Attachments.
3. Section 04200 - Masonry Walls
4. Section 05120 - Structural Steel, Miscellaneous Framing for Openings
5. Section 05311 - Steel Roof Deck
6. Section 09900 - Field Painting

##### 1.4 RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 "General Requirements" apply to work of this section.

2. Use this specification in conjunction with the General Notes and specific directives on the Contract Structural Drawings.
3. Perform work in accordance with Steel Joist Institute (SJI) Standard Specifications, Load Tables & Weight Tables for Steel Joist & Joist Girders.

## 1.5 REFERENCES

1. Steel Joist Institute (SJI)
  1. Recommended Code of Standard Practice for Steel Joists and Joist Girders.
  2. Standard Specifications, Load Tables, and Weight Tables for Steel Joists & Joist Girders.
    1. Standard Specs. for Open-Web Steel Joists, K-Series
    2. Standard Load Table Open-Web Steel Joists, K-Series
    3. Standard Specifications for Longspan and Deep Longspan Steel Joists, LH- and DLH-Series
    4. Standard Specification for Joist Girders
  3. Tech. Digest No. 1, Design of Compression Chords.
  4. Tech. Digest No. 2, Spacing of Bridging.
  5. Tech. Digest No. 3, Structural Design of Steel Joists to Resist Ponding Loads.
  6. Tech. Digest No. 4, Design of Fire-Resistive Assemblies
  7. Tech. Digest No. 5, Vibration of Steel Joist - Concrete Slab Floors
  8. Tech. Digest No. 6, Structural Design of Steel Joist Roofs to Resist Uplift Loads
  9. Tech. Digest No. 8, Welding of Open Web Steel Joists.
  10. Tech. Digest No. 9, Handling and Erection of Joists.
2. American Society for Testing and Materials (ASTM): See PART 2 - PRODUCTS for specific standards.
3. Federal Specifications (FS): FS TT-P-636, (red oxide) Primer Coating, Alkyd, Wood and Ferrous Metal
4. AWS D1.1 - Structural Welding Code

## 1.6 DESCRIPTION

Steel joists and joist girders are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

## 1.7 SUBMITTALS: Submit product data and shop drawings in accordance with Division 1 and SJI reference specifications.

1. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications."
2. Shop Drawings: Submit detailed drawings showing layout of joist units, special connections, joining and accessories. Include mark, number, type, location and spacing of joists and bridging.
  1. Provide templates or location drawings for installation of anchor bolts and metal bearing plates.
  2. Indicate joist types, sizes (by standard designations), configuration, spacing, location, connection, bridging, reinforcing, anchorages, cambers, and loads.
  3. Submit calculations and member shop drawings for all special joists indicated on plans.
  4. Indicate welded field connections using standard AWS welding symbols. Indicate net weld lengths.
  5. Show type of paint and all accessories and details required for proper installation of joists.
  6. Prepare shop drawings and calculations as required under seal of a licensed Professional Engineer registered in the State in which the project is located.
3. Welder's Certificates: Submit manufacturer's certificates under provisions of Spec. Section 01400 that welders employed on the work have met AWS verification within previous 12 months.

## 1.8 QUALITY ASSURANCE

1. Provide joists fabricated in compliance with the following, and as herein specified.

1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for:
  - \* K-Series Open Web Steel Joists (K-Series)
  - \* LH-Series Longspan Steel Joists (LH-StJst)
  - \* Joist Girders
2. Qualification of Welding: Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Standard Qualification Procedure". Joists welded in place are subject to inspection and testing. Expense of removing and replacing any portion of steel joists for testing purposes will be born by Owner if welds are found to be satisfactory. Remove and replace work found to be defective and provide new acceptable work.
3. Supplier furnish written certification that his current design(s) has been checked by SJI and found to conform to the applicable SJI Specifications and the recommended Code of Standard Practice for Steel Joists or furnish Design Verification Tests conforming to requirements of SJI Standard Specifications, Section 4.6 (K-Series), Section 103.8 (LH-DLH- Series) and Section 1003.8 (Joist Girders).
4. The Owner reserves the right to have his representative make an inspection of the joists prior to shipment.
5. Performance Test: If required, conduct performance tests in accordance with procedures described in SJI "Recommended Code of Standard Practice".

#### 1.9 DELIVERY, STORAGE AND HANDLING

1. Deliver, store, and handle steel joists as recommended in SJI "Specifications". Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.
2. Protect joists and girders from deterioration or damage.

#### 1.10 FIELD MEASUREMENTS

1. Verify that field measurements are as shown on shop drawings or as indicated by the Contractor.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND COMPONENTS

1. Open-web joist members, "K" Series: SJI Standard Specifications, Section 3 - Materials (Round-rod bottom chord members not permitted)

2. Longspan and Deep Longspan: SJI Standard Specifications for LH & DLH Series, Section 102 Materials.
3. Joist Girders: SJI Standard Specifications for Joist Girders
4. Welding materials: Applicable AWS D1.1, type required for materials being welded. For Open Web Steel Joists "K" Series conform to SJI Standard Specifications for Open Web Structural Joists, K Series, and to SJI Technical Digest No. 8, Welding of Open Web Steel Joists.
5. Anchor bolts and required nuts and washers: ASTM A307.
6. Primer Paint: See SJI Standard Specifications, Section 3.3 - Paint.
  1. SSPC Specification PS-15-68T Type 1 (red oxide) Steel Joist Painting System, Type I, Red Oxide Paint.

## 2.2 DESIGN AND FABRICATION

1. The Fabricator shall have complied with the requirements for Verifications of Design and Manufacture stipulated in the applicable SJI Specifications herein referenced.
2. Design and fabricate steel joists in accordance with SJI Standard Specifications, including headers and other support framing. Verify drawing dimensions and field conditions prior to commencing fabrication. Provide for concentrated loads shown on structural drawings.
3. Bottom Chord Extensions: Provide bottom joist chord extensions at all columns not framed in at least two directions with structural steel members and connect thereto or as otherwise shown on drawings.
4. Extended Ends: Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables and designed loads shown on the drawings.
5. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.
6. Bridging: Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications" and as noted on plans. Provide bridging anchors for ends of bridging lines terminating at walls or beams. Check standing seam roof deck systems where applicable and provide bridging as required to adequately brace top chords against

lateral movement under full loading condition. Check bridging design to accommodate uplift forces due to wind as noted on drawings.

7. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI "Specifications", unless otherwise indicated.
8. Header Units: Provide header units to support tail joists at openings in floor or roof system not shown framed with steel shapes.
9. Camber joists to allow for dead-load deflection as provided in the SJI Standard Specifications.
10. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint. Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil. Asphalt coating is not permitted where field painting is required.
11. Tolerances:
  1. Overall length:
    1. Up to 80 feet, maximum tolerance "3/8"
    2. 80 feet and over, maximum tolerance "1/2"
  2. Depth: Maximum tolerance -1/4", +1/2" measured at the panel point on the vertical axis of the joist
  3. Bearing ends:
    1. Depth: Maximum tolerance "1/8" on manufacturer's specified depth.
    2. Bearing surface squareness: Maximum tolerance of "3/8" per foot in transverse and longitudinal directions.
  4. Cross-section deviation:
    1. 3/16" maximum vertical displacement between the two members of a two-member top chord.
    2. 1/4" maximum vertical displacement between the two members of a two-member bottom chord.
  5. Slotted bearing connections:
    1. Maximum tolerance "3/8" on c to c of slots along length of joist.
    2. Maximum tolerance "1/8" on c to c of slots along gauge line.
  6. Camber: Maximum tolerance on Manufacturer's specified camber shall be "1/4" or " length (in inches)/1600 whichever is greater. No negative camber allowed and no consideration is made for joist weight deflection.



7. Lateral sweep: Shop tolerance shall not exceed 1/2" or length (in inches)/360 whichever is greater. Verification of shop tolerance shall be made prior to erection. Measurement shall be made by supporting the joist by its top chord at the approximate 1/3 points and letting it hang freely. The lateral displacement of the top chord from a straight line connecting the joist ends shall constitute the amount of lateral sweep.

## PART 3 - EXECUTION

### 3.1 HANDLING AND ERECTION (See SJI Specifications)

1. Handle, place, and secure steel joists and joist girders in accordance with SJI Standard Specifications. Protect joists and accessories from harmful elements and store above ground on platforms, pallets, or other supports. Keep joists free of dirt and other foreign matter.
2. Anchors: Furnish anchor bolts and other devices to be built into concrete and masonry construction. Furnish unfinished threaded fasteners for anchor bolts, unless otherwise indicated. Refer to Division-3 sections for installation of anchors set in concrete. Refer to Division-4 sections for installation of anchors set in masonry.
3. Placing Joists: Do not start placement of steel joists until supporting work is in place, properly aligned, and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.
4. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
5. Fastening Joists:
  1. Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used as noted on plans. Coordinate welding sequence and procedure with placing of joists.
  2. Secure joists resting on masonry or concrete bearing surfaces by bedding in mortar and anchoring to masonry or concrete construction as specified in SJI "Specifications" for type of steel joist used.
  3. Provide unfinished threaded fasteners for bolted connections, unless otherwise indicated.

4. Provide unfinished threaded fasteners for bolted connections except where high-strength bolts or welded connections are required and shown on shop drawings.
5. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in accordance with AISC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts".
6. Do not permit erection of decking until joists are sufficiently braced.
7. Obtain review and approval by Contracting Officer prior to field-cutting or altering of joists or bridging.
8. Damaged joists: Repair or replace all damaged joists as approved by Engineer.
9. Attachments to joists shall be made in such a manner or at such a location that local bending is not introduced into the joist chords.
10. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, and welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

END OF SECTION

## SECTION 05311

### STEEL ROOF DECK

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

1. Furnishing of and paying for all labor, materials, services, appliances, and equipment necessary for the execution, installation, and completion of all work specified herein.
2. Work included:
  1. 1 1/2" Deep steel roof deck and accessories
  2. Formed steel cant strips
  3. Framed openings up to and including 18 inches
  4. Bearing plates and angles

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Section 04311 - Installation of Anchors for Bearing Plates and Angles Embedded in Masonry.

##### 1.3 RELATED SECTIONS

1. Division 1 - Submittals and Quality Control
2. Section 05120 - Structural Steel
3. Section 05210 - Steel Joists and Joist Girders (Structural framed openings larger than 18 inches)
4. Section 05313 - Steel Floor Deck

##### 1.4 RELATED DOCUMENTS

1. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 - "General Requirements" apply to work of this section.
2. Use this specification in conjunction with the General Notes and specific directives on the Contract Structural Drawings.

## 1.5 REFERENCE STANDARDS

AMERICAN IRON AND STEEL INSTITUTE, (AISI)

"Specification for the Design of Cold-Formed Steel Structural Members"

AMERICAN SOCIETY FOR TESTING OF MATERIALS, (ASTM)

ASTM A36                      Structural Steel

ASTM A525                      Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A446                      Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A611                      Steel, Cold-Rolled Sheet, Carbon, Structural for painted deck

AMERICAN WELDING SOCIETY, (AWS)

ANSI/AWS D1.1 or D1.3      Structural Welding Code, AWS Specification for Welding Sheet Steel in Structures

STEEL DECK INSTITUTE, (SDI)

Design Manual for Composite Decks, Form Decks, Roof Decks, (89 Publications No. 28), including

1. Code of Recommended Standard Practice

2. Specs. and Commentary for Steel Roof Deck

2.      SDI, Diaphragm Design Manual

3.      SDI Pub. No. MC01, Manual of Construction with Steel Deck

2.      Factory Mutual System, "Factory Mutual System Approval Guide". (Steel Roof Decks and Fasteners - Class 1 Fire & 1-60 or 1-90 Windstorm Rated).

## 1.6 QUALIFICATIONS

1.      Installer: Company specializing in performing the work of this Section and approved by manufacturer.

1.7 SUBMITTALS: Submit shop drawings under provisions of Division.

1. Shop Drawings: Indicate decking plan, deck, gage and profile dimensions, supports, projections, attachments, openings, reinforcement, finishes, pertinent details, and accessories.
2. Product Data: Provide deck profile characteristics and dimensions, structural properties, and finishes.
3. Manufacturers Installation Instructions: Indicate specific installation sequence, special instructions, etc.

1.8 QUALITY ASSURANCE: (Conform to Spec. Division 1)

1. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated or specified:
  1. AISI "Specification for the Design of Cold-Formed Steel Structural Members".
  2. AWS "Structural Welding Code".
  3. SDI "Design Manual".
  4. SDI Manual of Construction with Steel Deck (Pub. No. MC01).
2. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
3. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification, as may be necessary in connection with fire and extended coverage insurance.

1.9 DELIVERY, STORAGE, AND HANDLING

1. Deliver products to site and store/protect under provisions of Division 1.
2. Store decking under provisions of Division 1 on dry wood sleepers with slope for positive drainage.
3. Cut plastic wrap to allow ventilation.

1.10 FIELD MEASUREMENTS

Verify that field measurements are as shown on drawings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

1. Subject to compliance with requirements, provide products of one of the following:

ASC Pacific, Inc.  
Bowman Metal Deck Div.  
Consolidated Systems, Inc.  
Epic Metals Corp.  
Marlyn Steel Decks, L.C.  
Roof Deck, Inc.  
United Steel Deck, Inc.  
Vulcraft/Div. Nucor Corp.  
Wheeling Corrugating Co.

2. Substitutions: Under provisions of Division 1.

### 2.2 MATERIALS

1. Sheet Steel: ASTM A446, Grade B or better, structural quality, with OR G90 galvanized coating, conforming to ASTM A 525,
2. Steel deck shall be minimum 22 gauge with no stiffening ribs on the top flange or bearing surface to provide maximum roofing contact area.
3. Sheet Metal Accessories: ASTM A526 commercial quality galvanized.
4. Bearing Plates and Angles: ASTM A36 steel.
5. Welding Materials: AWS D1.1.
6. Metal Closure Strips, Cover Plates, and Related Accessories: 20-gauge sheet steel; of required profiles and size.
7. Primer: Zinc chromate or red oxide type for painted deck.
8. Touch-up Primer: Red oxide, zinc chromate type.

### 2.3 FABRICATION (See SDI Design Manual)

1. Metal Decking: Minimum gauge shown on plans, sheet steel, 1-1/2 inches high, fluted profile as called for on plans; multiple span; lock seam joints.

2. Fabricate metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks to accommodate maximum working stress of 20,000 psi and maximum span deflection of 1/240.
3. Fabricate roof sump pan of sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, watertight.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

1. Erect and attach metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, Roof Decks. Provide welding in accordance with SDI Specifications and AWS D1.1.
2. On steel support members provide 1-1/2 inches minimum bearing. Align and level on supports.
3. On masonry or concrete support surfaces provide 4 inches minimum bearing. Align and level on supports.
4. Attachments: Steel deck units shall be anchored to supporting members, including bearing walls, to provide lateral stability to the top flange of the supporting structural members and to resist the following gross uplifts - 45#/sf for eave overhang and 30#/sf for all other roof areas. The dead load of the roof deck construction shall be deducted from the above uplift forces.
  1. Welds: Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent high amperage blowholes. Welds are made from the top side of the deck with the welder immediately following the placement crew. Puddle welds shall be at least 1/2 inch diameter or elongated welds with an equal perimeter. Fillet welds, when used, shall be at least 1 inch long. Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting members.
  2. Screws: The allowable load value per screw used to determine maximum fastener spacing for either self-drilling or standard metal type is based on minimum size 12 and on a minimum structural support thickness of 0.06 inches.
  3. Spacing of attachments for welds or screws: The location and number of welds or screws required for satisfactory attachment of deck to supporting structural members are as follows: all side laps plus a sufficient number of interior ribs to limit the spacing between adjacent points of attachment to 18 inches. For spans greater than 5 feet, side laps shall be fastened together at a maximum spacing of 3 feet center-to-center between supports.

4. Powder-actuated or pneumatically-driven fasteners: The allowable load value per fastener used to determine the maximum fastener spacing is based on a minimum structural support thickness of not less than 1/8 inch and on the fastener providing a 5/16-inch diameter minimum bearing surface (fastener head size). Powder-actuated and pneumatically-driven fasteners are recognized as viable anchoring methods, providing the type and spacing of said fasteners satisfies the design criteria. Documentation in the form of test data, design calculations, or design charts shall be submitted by the fastener manufacturer as the basis for obtaining approval.
5. Side laps shall be fastened with sheet metal screws at 3'-0" centers.
6. Reinforce deck openings from 6 to 12 inches in size with 2"x2"x1/4" steel angles. Place angles perpendicular to flutes. Extend minimum two flutes each side of opening and weld to deck.
7. Where steel deck ribs change direction an expansion joint shall be installed through the deck to relieve unequal stresses to the roofing membrane due to expansion and contraction of the deck.

END OF SECTION



## SECTION 05313

### STEEL FLOOR DECK

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

1. Furnishing of and paying for all labor, materials, services, appliances, and equipment necessary for the execution, installation, and completion of all work specified herein.
2. Work included:
  1. 2" Composite steel floor deck and accessories.
  2. Framed openings up to and including 18 inches.
  3. Bearing plates and angles.
  4. Shear stud connectors for structural composite construction.
  5. Formed steel deck and forms to contain wet concrete.
3. Work furnished but installed under other sections:
  1. Section 03300 - Furnish only anchorages for bearing plates and angles cast in concrete
  2. Section 04255 - Furnish only anchorages for bearing plates and angles embedded in masonry

##### 1.2 RELATED SECTIONS

1. Division 1 - General Conditions of the contract.
2. Section 03300 - Cast-In-Place Concrete Topping Slabs.
3. Section 05120 - Structural Steel.
4. Section 05210 - Steel Joists and Joist Girders (structural framed openings larger than 18").
5. Section 05311 - Steel Roof Deck.

6. Section 15000 - Mechanical and 16000 - Electrical, telephone, and other communications floor outlets, sleeves, gaskets, raceway, covers, and header duct.

### 1.3 RELATED DOCUMENTS

1. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 - "General Requirements" apply to work of this section.
2. Use this specification in conjunction with the General Notes and specific directives on the Contract Structural Drawings.

### 1.4 REFERENCES

1. Steel Deck Institute (SDI):
  1. Design Manual for Composite Decks, Form Decks, and Roof Decks, Publication No. 28 with the following standards included therein:
    1. SDI Specifications and Commentaries for Composite Steel Floor Deck.
  2. Diaphragm Design Manual.
  3. SDI Manual of Construction with Steel Deck (Pub. No. MC01).
2. American Welding Society (AWS) Welding Code ANSI/AWS D1.1 or D1.3 Spec. for Welding Sheet Steel in Structures.
3. American Iron and Steel Institute (AISI) Specifications for the Design of Cold-Formed Steel Structural Members.
4. American Society of Testing and Materials (ASTM).
5. Underwriters Laboratory (UL) Fire Resistance Ratings on Standard Assemblies, "Fire Resistance Directory".

### 1.5 QUALIFICATIONS:

1. Installer: Company specializing in performing the work of this section and approved by manufacturer.

1.6 SUBMITTALS Submit shop drawings under provisions of Division 1.

1. Shop Drawings: Indicate decking plan, deck profile dimensions, supports, projections, openings, reinforcement, finish, pertinent details, and accessories. Indicate temporary shoring where required.
2. Mill Test Reports: Submit mill test reports of materials for all deck to be furnished with first shop drawing submittal.
3. Product Data: Provide deck profile characteristics and dimensions, structural properties, finishes, etc.
4. Manufacturer's Installation Instructions: Indicate specific installation sequence, special instructions, etc.

1.7 QUALITY ASSURANCE: (Conform to Spec. Division 1)

1. Codes and standards: Comply with provisions of the following codes and standards, except as otherwise indicated or specified:
  1. AISI Specifications for the Design of Cold-Formed Steel Structural Members.
  2. AWS Welding Code D1.1.
  3. SDI Design Manual No. 28.
  4. SDI Manual of Construction with Steel Deck (Pub. No. MC01).
2. Qualification of field welding:
  1. AWS Standard Qualification Procedure
3. Underwriters' label: Each deck unit shall bear the UL label and marking for the specific system called for on the plans and be listed in the Underwriters' Laboratories "Fire Resistance Directory".

1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver products to site, store and protect products, under provisions of Division 1. Cut plastic wrap to ventilate.
2. Store decking under provisions of Division 1 on wood sleepers with slope for positive drainage.

## 1.9 FIELD MEASUREMENTS

1. Verify that field measurements are as shown on drawings. Adjust for discrepancies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

1. Subject to compliance with requirements, provide products of one of the following:  
ASC Pacific, Inc.  
Bowman Metal Deck Div.  
Consolidated Systems, Inc.  
Epic Metals Corp.  
Marlyn Steel Decks, L.C.  
Roof Deck, Inc.  
United Steel Deck, Inc.  
Vulcraft/Div. Nucor Corp.  
Wheeling Corrugating Co.

2. Substitutions: Under provisions of Division 1.

### 2.2 MATERIALS: See SDI Design Manual.

1. Galvanized Sheet Steel: ASTM A446, Grade A Structural Quality; with G90 galvanized coating conforming to ASTM A525. Minimum yield strength: 33000 psi.

Bearing Plates Angles: ASTM A36 steel, unfinished.

2. Galvanized repair paint: MIL-P-21035 (ships).
3. Shear connectors: (for composite beams) AWS D1.1, Articles 4.23, 4.26, and 4.27. Headed stud type, ASTM A108, Grade 1015 or 1020, cold-finished carbon steel 3/4 inch diameter.
4. Welding materials: Applicable AWS D1.1 type required for materials to be welded.
5. Flexible Flute Closures: Closed cell foam rubber, one inch thick, profiled to fit tight to the decking.
6. Sheet Metal Accessories: ASTM A526, commercial quality, galvanized.

## 2.3 FABRICATION

1. General: Fabricate floor deck units in lengths to span three or more supports with flush, telescoped, or nested 2" laps at ends and interlocking or nested side laps unless otherwise indicated.
2. Fabricate deck units with integral embossing or raised pattern to furnish mechanical bond with concrete slabs; of metal thickness, depth, and width as shown on drawings.
3. Metal cover plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.
4. Metal closure plates: Fabricate metal closure plates for closing deck to columns, angle beams, etc., of not less than 18-gauge material galvanized. Form to close deck flutes and lap on the deck approximately 2" minimum.
5. Metal closure strips: Fabricate metal closure strips for openings between decking and other construction of not less than 0.045" min. (18 gauge) sheet steel. Form to provide tight-fitting closures at open ends of flutes and sides of decking.
6. Fabricate floor drain pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.
7. Fasteners: Stainless or Galvanized hardened steel, self-tapping.
8. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 thick.

## 2.4 DELIVERY AND STORAGE

1. Deliver materials at approximate scheduled time for installation and in such manner as to avoid possible material contamination and injury to coating so that steel deck, when received, can be installed immediately and roofed over properly.
2. Steel decking not promptly erected shall be stored off the ground with one end elevated for drainage and shall be protected from the elements with a waterproofed covering. When placing bundles of steel deck on the roof, care shall be exercised to avoid overloading the supporting structural members.

## PART 3 - EXECUTION

### 3.1 INSPECTION

1. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work.
2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Beginning of installation means installer accepts existing conditions.

### 3.2 INSTALLATION

1. See SDI Specifications and Commentaries for Composite Steel Floor Deck, Section 4.
2. General: Install deck units and accessories in accordance with Manufacturer's recommendations and approved shop drawings and as specified herein.
  1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before fastening permanently. Do not stretch or contract side lap interlocks.
  2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
  3. Place deck units flat and square and secure to adjacent framing without warp or excessive deflection.
  4. Coordinate work and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
  5. Do not use deck units for storage or working platforms until permanently secured.
  6. Bear decking on masonry support surfaces with 4 inch minimum bearing. Align and level.
  7. Bear decking on steel supports with 1 1/2 inch minimum bearing. Align and level.
3. Fastening deck units:
  1. Follow Manufacturer's approved shop drawing requirements unless otherwise called for on the contract drawings.

2. Fasten ribbed deck to steel support members at ends and intermediate supports with fusion welds through weld washers or approved mechanical fasteners at 12 inches o.c. maximum, parallel with the deck flute and at each transverse flute.
3. Mechanical fasteners: Mechanical fasteners (powder-actuated, screws, pneumatically-driven fasteners, etc.) may be used provided the type and spacing of the fasteners satisfy the design criteria. Documentation in the form of test data, design calculations, or design charts should be submitted by the fastener manufacturer as the basis for obtaining approval. The deck manufacturer may recommend additional fasteners to stabilize the given profile against sideslip of any unfastened ribs.
4. Tack weld or use machine screws at 4'-0" o.c. for fastening end closures.
5. Comply with AWS requirements and procedures for manually shielded metal arc welding, appearance, quality of welds, and methods used in correcting welding work. Use welding washers where recommended by deck manufacturer.
6. Lock side laps of adjacent deck units between supports at intervals not exceeding 36" o.c. in full accord with Manufacturer's recommendations. Special attachment may be required for seismic, tornadic, or hurricane diaphragm forces designed according to SDI Diaphragm Design Manual.
4. Cutting and fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown. Close around all columns.
5. Reinforcement at openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.
6. Hanger slots or clips: Provide UL approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends and not more than 12" from walls at sides unless otherwise shown or provide Manufacturer's standard hanger attachment devices.
7. Joint covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units except where taped joints are required.
8. Shear connectors: Weld shear connectors to supports through decking units in accordance with Manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

9. If the supporting members are not in alignment or at the proper level or location, correction as performed by others will be made upon notification by this Contractor. See Division 1.
10. Mechanical fastening shall be provided at all side laps with the spacing between side lap fasteners and steel supports not exceeding 2'-0". If an interlocking deck is used, fastening may be accomplished by crimping the interlock with button punch. Overlapping sheets require self-tapping screws no smaller than No. 12. Welding of side laps is not permitted.
11. Cutting and fitting openings: The Contractor shall provide all holes and openings for stacks, pipes, drains, ventilators, scuttles, and other projections through the floor as shown and located on the drawings. Openings shall be cut and fitted neatly and shall be reinforced as necessary for rigidity and load-bearing capacity.
12. Reinforce steel deck openings from 6 to 18 inches in size with 2x2x inch steel angles. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld or mechanically attach to deck at each flute.
13. Install 6 inch minimum wide sheet steel cover plates, of same thickness as decking, where deck changes direction. Fusion weld inches o.c. maximum.
14. To contain wet concrete, install stops at floor edge upturned to top surface of slab. Provide stops of sufficient strength to remain stationary without distortion.
15. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.

### 3.3 FIELD TOUCH-UP PAINTING

1. Touch-up painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with Manufacturer's instructions. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.
2. Section 09900 - Field painting other than touch-up.

END OF SECTION



## SECTION 05400

### COLD FORMED METAL FRAMING

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

1. Load bearing cold formed steel stud exterior wall, and framing to support laterally the brick veneer except as modified or augmented in Section 04255 - Nonbearing Masonry Veneer/Steel Stud Walls.

##### 1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1. Section 08410 - Aluminum Entrances and storefronts. Anchors for support of door frames.
2. Section 08520 - Aluminum Windows. Anchors for support of window frames.

##### 1.3 RELATED SECTIONS

1. Section 04255 - Nonbearing Masonry Veneer/Steel Stud Walls
2. Section 04320 - Veneer Masonry System: Veneer masonry supported by wall stud metal framing
3. Section 05120 - Structural Steel
4. Section 05311 - Steel Roof Deck: Metal roof decking
5. Section 05313 - Steel Floor Deck: Metal floor decking
6. Section 06114 - Wood Blocking and Curbing: Rough wood blocking
7. Section 04320 - Veneer Masonry. Head and sill flashings
8. Section 07213 - Batt Insulation: Insulation within framing members
9. Section 07900 - Joint Sealers
10. Section 09111 - Metal Stud Framing System - Interior partitions
11. Section 09206 - Metal Furring and Lathing

12. Section 09220 - Portland Cement Plaster
13. Section 09260 - Gypsum Board Systems: Light weight, non-load bearing metal stud framing
14. Section 09511 - Suspended Acoustical Ceilings: Ceiling suspension system

#### 1.4 REFERENCES

1. AISI - American Iron and Steel Institute - Cold-Formed Steel Design Manual.
2. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process, Physical (Structural) Quality.
4. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
5. ASTM A570 - Hot-Rolled Carbon Steel Sheet and Strip. Structural Quality.
6. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
7. ASTM A645 - Steel Sheet, Pressure Vessel Plates, Five Percent Nickel Alloy Steel, Specially Heat Treated.
8. ASTM C955 - Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
9. AWC (Association of Wall and Ceiling Industries) - Specifications Guide for Cold Formed Steel Structural Members.
10. AWS D1.1 - Structural Welding Code.
11. AWS D1.3 - Light Steel Welding Code.
12. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
13. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

#### 1.5 SYSTEM DESCRIPTION

1. Indicated on structural drawing general notes.

2. Maximum Allowable Deflection: see specification section 04255.
3. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
4. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.6 SUBMITTALS: Submit under provisions of Division 1.

1. Shop Drawings: Indicate component details, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work. Indicate stud layout.  
Describe method for securing studs to tracks and for bolted and/or welded framing connections.
2. Calculations: Provide calculations for loadings and stresses of wall system and connections under the Professional Structural Engineer's seal.
3. Product Data: Provide data on standard framing members; describe materials and finish, product criteria and limitations.

1.7 QUALITY ASSURANCE

1. Calculate structural properties of framing members in accordance with AWCI, MFMA, and AWS D1.3 requirements.
2. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
2. Installer: Company specializing in performing the work of this section approved by manufacturer.
3. Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

## 1.9 FIELD MEASUREMENTS

1. Verify that field measurements are as indicated on shop drawings.

## 1.10 COORDINATION

1. Coordinate with the placement of components within the stud framing system, specified in Section 04320.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

1. Dale/Incor Industries, Dearborn, MI: Steel Framing
2. Clark Steel Framing Systems, Cincinnati, OH: Steel Framing
3. Unimast Incorporated, Franklin Park, IL: Steel Framing

## 2.2 FRAMING MATERIALS

- A. Studs: ASTM A446, A525, A570, A611, A645 Grade [\_\_\_\_] sheet steel, formed to channel shape, punched web. See plans for depth and gage.
1. Track: Formed steel; channel shaped; same width as studs, tight fit; 20 gage minimum, solid web.

## 2.3 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, 20 gage minimum thickness, unless noted on plans.
- B. Plates, Gussets, Clips: Formed sheet steel, inch 16 gage minimum, unless noted on plans.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20.

## 2.4 FASTENERS

1. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: ASTM A123, hot dip galvanized to 1.25 oz/sq ft (380 gm/sq m).
2. Anchorage Devices: Power actuated, drilled expansion bolts.

3. Welding: In conformance with AWS D1.1 and AWS D1.3.

## 2.5 FABRICATION

1. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.
2. Fit and assemble in largest practical sections for delivery to site, ready for installation.

## 2.6 FINISHES

1. Studs: Galvanize to G90 coating class.
2. Tracks and Headers: Galvanize to G90 coating class.
3. Joists and Purlins: Galvanize to G90 coating class.
4. Bracing, Furring, Bridging: Same finish as framing members.
- 5.
6. Plates, Gussets, Clips: Same finish as framing members.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

1. Verify site conditions under provisions of Division 1.
2. Verify that building framing components are ready to receive work.

## 3.2 ERECTION OF STUDDING

1. Install components in accordance with manufacturer's instructions.
2. Align floor and ceiling tracks; locate to partition layout. Secure in place with fasteners at maximum 24 inches (600 mm) oc. Coordinate installation of sealant with floor and ceiling tracks.
3. Place studs at 16 inches (400 mm) oc; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
4. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.

5. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
6. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
7. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
8. Install intermediate studs above and below openings to align with wall stud spacing.
9. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
10. Attach cross studs to studs for attachment of fixtures anchored to walls.
11. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
12. Touch-up field welds and damaged galvanized surfaces with primer.

### 3.3 ERECTION TOLERANCES

1. Maximum Variation from True Position: 1/2 inch.
2. Maximum Variation of any Member from Plane: 1/4 inch.

END OF SECTION

## SECTION 05500

### METAL FABRICATIONS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items.
- B. Shop fabricated non-ferrous metal items.
- C. Battery Rack: non-metallic.
- D. Nosing for cast-in-place concrete.

##### 1.2 RELATED SECTIONS

- A. Section 05120 - Structural Steel: Structural steel column beams and anchor bolts.
- B. Section 05210 - Steel Joists and Joist Girders: Structural joist, joist girders, bearing plates, including anchorage.
- C. Section 05311 - Steel Roof Deck: Bearing plates and angles for metal deck bearing, including anchorage.
- D. Section 05510 - Metal Stairs.
- E. Section 09900 - Painting: Paint finish.
- F. Section 03300 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.
- G. Section 04311 - Concrete Masonry Units: Placement of metal fabrications in masonry.

##### 1.3 REFERENCES

- A. ANSI A14.3 - Ladders, Fixed, Safety Requirements.
- B. ASTM A36 - Structural Steel.
- C. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- D. ASTM A209 - Specification for Aluminum and Aluminum - Alloy Sheet and Plate.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

- F. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- G. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- H. AWS A2.0 - Standard Welding Symbols.
- I. AWS D1.1 - Structural Welding Code.
- J. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

#### 1.4 SUBMITTALS:

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of asteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

#### 1.5 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- B. Welders Certificates: Submit under provisions of Division 1, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

### PART 2 PRODUCTS

#### 2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Steel Pipe and Railing: ASTM A53, Grade B Schedule 40.
- E. Fasteners:
  - 1. General - Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.



- a) Bolts and Nuts: Regular hexagon - head bolts, ASTM A307, Grade A (ASTM F568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and where required, flat washers.
  - b) Machine Screws: ANSI B186.3.
  - c) Lag Bolts: ANSI B18.2.1 (ANSI B18.23.8M)
  - d) Plain Washers: Round, carbon steel, ANSI B 18.22.1 (ANSI B18.22M).
  - e) Expansion Anchors: Anchors, bolt and sleeve assembly of materials indicated below with capability to sustain, without failure a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
    - (1) Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- F. Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Ladders: ANSI A14.3.
- I. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic zinc rich.

## 2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221, Alloy 6063, Temper T5.
- B. Sheet Aluminum: ASTM B209, Alloy Temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, Alloy 6063 Temper T6.
- D. Aluminum-Alloy Bars: ASTM B211, Alloy 6063, Temper T6.
- E. Bolts, Nuts, and Washers: Steel, galvanized to ASTM A153.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Trench Drain and Piping Trench

1. The channel for trench drain shall have a built-in slope of 1/8" per foot. The channels for the pipe trenches are flat and have no slope. The channel sections shall come in either 6 or 12 foot lengths. The channels shall be constructed of 1/8 inch thick fiberglass.
  2. The grating for the trench drain shall be constructed of ductile iron having a capacity of Load Class C: heavy duty.
  3. The covers for the pipe trench shall be solid galvanized steel (reinforced) having a capacity of Load Class C: heavy duty.
  4. Both trench covers (the grating for trench drains and cover for the pipe trench) shall meet ADAAG Sec. 4.54.L.D.-810/A.N.-0068.
- H. Mooring Eye: Catalog No. R-3490-"F"-3-1/2", constructed in ductile iron as manufactured by Neenah Foundry Co., Box 729, Neenah, WI 54957, phone: (414) 725-7000.
- I. Aluminum grating shall conform to the following:
1. Design Load - uniform load of 100 psf.
  2. Maximum clear span deflection of 1/4 inch.
  3. Maximum fiber stress: 12,000 psi.
  4. Material:
    - a. Bearing bar, plank section or grating frame: alloy 6063-T6; conform to ASTM B221. Cross bars and connecting bars are same as bearing bar.
  5. Fabrication: conform to NAAMM Metal Bar Grating Manual designated ANSI/NAAMM MBG 531.
  6. Provide (aluminum saddle clips) for grating hold down.
  7. Grating Type: Rectangular Bar SG Series. Bearing bar size: 1-1/2" x 3/16".
- J. Battery Rack shall conform to the following:
1. Manufacturer - Aicken strut a Subsidiary of Robroy Industries, Rive Road, Verona, PA 15147, Phone 800-426-4293. Unistrut Corporation, 35660 Clinton Street, Wayne, Michigan 48184, Phone: 800-937-8788.
  2. Channel framing shall be 1500 Series 1 1/2 inch standard duty Aicken strut, polyester type.

3. Shelf Units: Fiberglass reinforced polyester grating with a 67% open area with nominal square mesh pattern at 1 1/2" x 1 1/2" and 1 1/2" thick. All fasteners shall be constructed of reinforced polyurethane.

K. Nosing for new cast-in-place concrete steps shall conform to the following:

1. The nosing shall have an abrasive cross-hatch for the full length of its width. The abrasive cast aluminum shall be No. 43 prime and secondary ingot; low copper content and corrosion-resistant. Abrasive shall be #20 virgin aluminum oxide abrasive, integrally cast into the walking surface to a minimum depth of 1/32 inch (.79mm).
2. Safety nosing up to 6" (152.4mm) deep shall have cross-hatched surface installed into wet concrete and shall have a feature strip along the back edge.
3. Concrete type anchors shall be slotted rivet type integrally cast into the body of the nosing a minimum of 3/8 inch (9.53 mm).
4. Manufacturers:
  - a. Granite State Casting Co.  
127 Fitchburg Road  
Route 31  
Greenville, New Hampshire 03048  
Phone: (800) 638-7543
  - b. Safe-T-Metal Company, Inc.  
261 Jericho Turnpike  
Mineola, N.Y. 11501  
Phone: (800) 886-7238
  - c. Wooster Products, Inc.  
1000 Spruce St., P.O. Box 6005  
Wooster, Ohio 44691  
Phone: (800) 321-4936

## 2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

## 2.4 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 60 inches.
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 60 inches.

## 2.5 FINISHES - STEEL

- A. Prepare surfaces to be primed in accordance with SSPC SP 2.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat.
- D. Non-structural Items: Galvanized after fabrication to ASTM A123. Provide minimum 1.25 oz/sq ft (380 g/sq m) galvanized coating.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

### 3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

### 3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.

- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

### 3.5 SCHEDULE

- A. The following Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint, galvanized finish.
- C. Ledge and Shelf Angles, Not Attached to Structural Framing: For support of masonry; prime paint finish.
- D. Lintels: As detailed; prime paint finish.
- E. Door Frames for Overhead Door Openings: Channel, Angle sections; prime paint finish.
- F. Steel Railings for exterior stairs: Pipe rails shall have all weld joints ground smooth, prime paint finish. Provide wall brackets or sleeves as indicated.

END OF SECTION



## SECTION 05510

### PREMANUFACTURED METAL STAIRS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Steel stair frame of structural sections, with closed risers.
- B. Pan to receive concrete fill stair treads and landings.
- C. Integral balusters and handrailing.

##### 1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Concrete fill in stair pans and landings; mesh reinforcement for landings.
- B. Section 05520 - Handrails and Railings: Handrails and balusters other than specified in this Section.
- C. Section 09900 - Painting: Paint finish.

##### 1.3 REFERENCES

- A. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability For Physically Handicapped People.
- B. ASTM A36 - Structural Steel.
- C. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A202.1 - Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads.
- F. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- G. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- H. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- I. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

- J. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- K. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- L. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- M. AWS A2.0 - Standard Welding Symbols.
- N. AWS D1.1 - Structural Welding Code.
- O. SSPC - Steel Structures Painting Council.

#### 1.4 DESIGN REQUIREMENTS

- A. Fabricate stair assembly to support live load of 150 lb/sq ft with deflection of stringer or landing framing not to exceed 1/240 of span.
- B. Railing assembly, wall rails, and attachments to resist lateral force of 200 lbs at any point without damage or permanent set.
- C. Applicable code requirements shall meet or exceed all local, state, federal codes, and ADA requirements that are applicable to the design of a stair and railing system.

#### 1.5 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

#### 1.6 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- B. Welders' Certificates: Submit information certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

#### 1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.



## PART 2 PRODUCTS

### 2.1 PREMANUFACTURED METAL STAIR MATERIALS:

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Plates: ASTM A283.
- D. Pipe: ASTM A53, Grade B Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- E. Sheet Steel: ASTM A446, Grade B Structural Quality with 1.25 oz/sq ft.
- F. Stair Treads: Prefabricated factory assembled and poured stairwell package, consisting of the following:
  - 1. Epoxy compound at 3/8-inch thick which has cured to a compressive strength of 14,000 psi.
  - 2. Resistant to chemical, industrial and acids.
  - 3. Noise absorbant and fire resistant.
- G. Concrete for Landings: Portland cement Type I psi (20 MPa) 28 day strength, 2 to 3 inch slump.
- H. Landing Concrete Reinforcement: Mesh type galvanized.
- I. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
- J. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.
- K. Welding Materials: AWS D1.1; type required for materials being welded.
- L. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

### 2.2 FABRICATION - GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Continuously seal jointed pieces by intermittent welds and plastic filler.

- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- G. Accurately form components required for anchorage of stairs and landings and railings to each other and to building structure.

### 2.3 FABRICATION - PAN STAIRS AND LANDINGS

- A. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.
- B. Form treads and risers with minimum 24 gage sheet steel stock.
- C. Secure reinforced tread pans to stringers with clip angles; welded in place.
- D. Form stringers with rolled steel channels, 12 inches.
- E. Form landings with minimum 12 gage sheet stock. Reinforce underside with angles to attain design load requirements.
- F. Form balusters with 1-5/8 inch diameter 13 gauge steel tubing, welded to stringers.
- G. Prime paint all components.

### 2.4 FINISHES

- A. Prepare surfaces to be primed in accordance with SSPC SP 2.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

### 3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

### 3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, angles required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.
- E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible.
- F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- G. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

END OF SECTION



## SECTION 06114

### WOOD BLOCKING AND CURBING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Roof curbs and cants.
- B. Blocking in wall and roof openings.
- C. Wood furring and grounds.
- D. Concealed wood blocking for support of toilet and bath accessories and wall cabinets.
- E. Telephone and electrical panel boards.
- F. Preservative treatment of wood.

##### 1.2 RELATED SECTIONS

- A. Section 07610 - Pre-Finish Metal Roofing.
- B. Section 07620 - Sheet Metal Flashing and Trim.
- C. Section 07710 - Manufactured Roof Specialties.

##### 1.3 REFERENCES

- A. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- B. APA: American Plywood Association.
- C. AWWA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.
- D. AWWA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- E. NFPA: National Forest Products Association.
- F. SPIB: Southern Pine Inspection Bureau.

G. WCLIB: West Coast Lumber Inspection Bureau.

H. WWP: Western Wood Products Association.

#### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:

1. Lumber Grading Agency: Certified by ALSC.
2. Plywood Grading Agency: Certified by APA.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Lumber Grading Rules: NFPA SPIB WCLIB WWP.
- B. Miscellaneous Framing: Stress Group D Southern Pine species, 19 percent maximum moisture content, pressure preservative treat.
- C. Plywood: APA Structural I, Grade C-D with exterior glue; Exposure Durability 1; sanded.

#### 2.2 ACCESSORIES

- A. Fasteners and Anchors:
1. Fasteners: Hot-dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
  2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

#### 2.3 FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWP Treatment C1 using water borne preservative with 0.25 percent retainage.

### PART 3 EXECUTION

#### 3.1 FRAMING

- A. Set members level and plumb, in correct position.
- B. Place horizontal members flat, crown side up.

- C. Construct curb members of single pieces.
- D. Space framing and furring 16 inches o.c.
- E. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- F. Coordinate curb installation with installation of decking and support of deck openings.

### 3.2 SHEATHING (PLYWOOD)

- A. Secure sheathing to framing members with ends over firm bearing and staggered.
- B. Install telephone and electrical panel boards with plywood sheathing material where required. Over size the panel by 12 inches on all sides.

### 3.3 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

### 3.4 SCHEDULES

- A. Roof Blocking: S/P/F species, 19 percent maximum moisture content, pressure preservative treatment.
- B. Telephone and Electrical Panel Boards: 3/4 inch thick, square edges, site brush applied preservative treated.

END OF SECTION





## SECTION 06182

### GLUE LAMINATED ENTRANCE STRUCTURE

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Glue laminated wood entrance structure.
- B. Steel hardware and attachment brackets.

##### 1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Setting anchors in foundations.
- B. Section 09900 - Painting: Field finishing.

##### 1.3 REFERENCES

- A. AITC (American Institute of Timber Construction).
- B. ALSC (American Lumber Standards Committee).
- C. ANSI A190.1 - Structural Glued Laminated Timber.
- D. APA/EWS - American Plywood Association - Engineered Wood Systems.
- E. ASTM A36/A36M - Structural Steel.
- F. ASTM A123 - Zinc (Hot Galvanized) coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
- G. ASTM A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
- H. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- I. ASTM D2559 - Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions.
- J. AWWA (American Wood Preservers Association).

- K. AWS D1.1 - Structural Welding Code.

#### 1.4 DESIGN REQUIREMENTS

- A. Design and laminate members to AITC 117 Standard.
- B. Design entrance structure to local wind and seismic loads in accordance to UBC guidelines with deflection limited to  $1/240$  of span.

#### 1.5 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.
- C. Shop Drawings: Indicate sizes of members and anchor details.

#### 1.6 SUBMITTALS FOR INFORMATION

- A. Division 1 - Submittals: Procedures for submittals.
- B. Submit design calculations.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer/Fabricator: Company specializing in manufacture of glue laminated structural units with three years experience, and certified by AITC in accordance with ANSI A190.1.
- B. Erector: Company specializing in erection of this Work with six years documented experience.
- C. Design members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Project.
- D. Perform welding Work in accordance with AWS D1.1.
- E. Perform Work in accordance with State of Washington, City of Seattle standards.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for loads, seismic zoning, and other load criteria.

## 1.9 DELIVERY, STORAGE, AND PROTECTION

- A. Protect members to AITC requirements for load wrapped.
- B. Leave individual wrapping in place until finishing occurs.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Manufacturers:
  - 1. G-L Industries, P.O. Box 218, Magna, Utah 84044, Phone: (801) 250-3391.
  - 2. QB Corporation, Route #1, Box 49, QB, Salmon, ID 83467-9712, Phone: (208) 756-4248.
  - 3. Timberweld Manufacturing, P.O. Box 21000, Billings, MT 59104, Phone: (406) 652-3600.
- B. Lumber: Alaska Yellow Cedar lumber conforming to grading rules with 12 percent maximum moisture content before fabrication. Use only heartwood for this structure sapwood not approved. Design for the following values:
  - 1. Bending (Fb): 2,000 psi (13,780 kPa).
  - 2. Tension Parallel to Grain (Ft): 900 psi (6,201 kPa).
  - 3. Compression Parallel to Grain (Fc): 1,500 psi 10,335 kPa).
  - 4. Compression Perpendicular to Grain Bottom (Fc1): 560 psi (3,858 kPa).
  - 5. Compression Perpendicular to Grain Top (Fc1): 560 psi (3858 kPa).
  - 6. Horizontal Shear (Fv): 190 psi (1,309 kPa).
  - 7. Modulus of Elasticity (E): 1.5 million psi.
- C. Steel Connections and Brackets: ASTM A36/A36M weldable quality, hot dip galvanized to 1.5 oz/sq ft (390 g/sq m) to ASTM A123.
- D. Anchor Bolts: ASTM A325 steel; galvanized.
- E. Laminating Adhesive: AITC A190.1 for wet condition of service.
- F. Bearing Plate Anchors: Bolts or ballistic fasteners for anchorage to steel.
- G. Metal Primer: Salt-spray environment type.

## 2.2 WOOD TREATMENT

- A. Shop treat wood materials in accordance with manufacturer's instructions.

## 2.3 FABRICATION

- A. Fabricate glue laminated structural members in accordance with AITC Architectural grade.
- B. Verify dimensions and site conditions prior to fabrication.
- C. Cut and fit members accurately to length to achieve tight joint fit.
- D. Fabricate member with camber built in.
- E. Do not splice or join members in locations other than those indicated without permission.
- F. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
- G. After end trimming, seal with penetrating sealer, sealer coat in accordance with AITC requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that supports are ready to receive units.
- B. Verify sufficient end bearing area.

### 3.2 PREPARATION

- A. Coordinate placement of bearing support items.

### 3.3 ERECTION

- A. Lift members using protective straps to prevent visible damage.
- B. Set structural members level and plumb, in correct positions or sloped where indicated.
- C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

- D. Fit members together accurately without trimming, cutting, or other unauthorized modification.
- E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

### 3.4 TOLERANCES

- A. Framing Members: 1/2 inch (12 mm) maximum from true position.

END OF SECTION



## SECTION 06200

### FINISH CARPENTRY

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hardware and attachment accessories.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 06114 - Wood Blocking and Curbing: Installation of recessed wood blocking and nailers.

##### 1.3 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Grounds and support framing.
- B. Section 08211 - Flush Wood Doors.
- C. Section 09900 - Painting: Painting and finishing of finish carpentry items.

##### 1.4 REFERENCES

- A. ANSI A135.4 - Basic Hardboard.
- B. ANSI A208.1 - Mat Formed Wood Particleboard.
- C. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI - Quality Standards.
- E. AWP (American Wood Preservers Association) C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
- F. AWP (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- G. BHMA A156.9 - Cabinet Hardware.
- H. FS MMM-A-130 - Adhesive, Contact.

- I. HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.
  - J. NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.
  - K. NHLA (National Hardwood Lumber Association).
  - L. NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellant Preservative Treatment for Millwork.
  - M. PS 1 - Construction and Industrial Plywood.
  - N. PS 20 - American Softwood Lumber Standard.
- 1.5 SUBMITTALS: Submit under provisions of Division 1.
- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, and to a minimum scale of 1-1/2 inch to 1 ft.
  - B. Hardware Instruction: Provide instructions for attachment hardware and finish hardware.
- 1.6 QUALITY ASSURANCE
- A. Perform work in accordance with AWI Custom quality.
- 1.7 QUALIFICATIONS
- A. Fabricator: Company specializing in fabricating the products specified in this section with minimum four years documented experience.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.
  - B. Protect work from moisture damage.
- 1.9 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings instructed by the manufacturer.



## 1.10 COORDINATION

- A. Coordinate the work with plumbing and electrical rough-in, installation of associated and adjacent components.

## PART 2 PRODUCTS

### 2.1 SHEET MATERIALS

- A. Wood Particleboard: ANSI A208.1 Type 1; AWI standard, composed of wood chips, medium density, made with high waterproof resin binders of grade to suit application; sanded faces.

### 2.2 PLASTIC LAMINATE MATERIALS

- A. Plastic Laminate: NEMA LD 3, GP - 50 General Purpose for horizontal surfaces and GP28. Color pattern and matte as selected.
- B. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate.

### 2.5 ADHESIVE

- A. Adhesive: FS MMM-A-130 contact adhesive. Type recommended by laminate manufacturer to suit application.

### 2.6 FASTENERS

- A. Fasteners: Of size and type to suit application; US32D finish in concealed locations and same finish in exposed locations.
- B. Concealed Joint Fasteners: Threaded steel.

### 2.7 ACCESSORIES

- A. Lumber for Shimming, Blocking, and Birch: Softwood lumber of Douglas species.
- B. Plastic Edge Trim: Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.
- C. Primer: Alkyd primer sealer type.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

## 2.8 WOOD TREATMENT PROCESSES

- A. Wood Preservative by Pressure Treatment (PT Type): AWWA Treatment C2 using water borne preservative with 0.25 percent retainage.

## 2.9 SHOP TREATMENT OF WOOD MATERIALS

- A. Shop pressure treat treatment to wood materials requiring preservatives to concealed wood blocking.
- B. Redry wood after pressure treatment to maximum 6-10 percent moisture content.

## 2.10 HARDWARE

- A. Hardware: BMHA A 156.9 as follows:
  - 1. Hinges: Euro-style hinge with concealed knuckle; 170 degrees swing with self closing capability at less than 90 degrees to its closed position; clip concealed hinge shall pass Section 4.2; 4.3 (hinge operating life test) and 4.3 (Self Closing Hinge Test) of ANSI/BHMA A 156.9. Hinges to be nickel plated.
  - 2. Pulls: Wire pulls with center to center dimension of 3-1/2 inches, outer dimension of 5/16 inches in diameter, and a projection of 1-5/16 inches. The wire pulls shall be stainless steel in a US32D finish.
  - 3. Latches are not required due to the type of hinges specified. Select latches only when seismic condition warrant their use.
  - 4. Shelf Standards are 5/8 inch in width and 3/16 of an inch in height. This type of standard is used where shelves are supported along the two ends. There shall be four vertical standards for support. Standards shall be recessed in the vertical walls of the casework. Appropriate shelf supports with rubber cushion shall be used.

Where adjustable shelving is required but no end supports are used, provide steel brackets and standards for the adjustable shelving requirements. Steel brackets shall be deep enough to carry the full depth of the shelving. Finish for steel standards and brackets shall be anodized chrome.

- 5. Drawer slides shall have the following load capacities according to BHMA for dynamic rating of 75 lbs and static rating of 100 lbs. The slides shall have a self-close/stay-closed action, epoxy coated steel, nylon rollers, bottom corner mounting, captive RH profiles, tolerance compensating LH profiles, 1/2 inch side clearance, double warning stop with lock out position, exceeds BMHA Grade 1 requirements, and 3/4 extension drawer runners.

## 2.11 FABRICATION

- A. Fabricate to AWI Custom standards.

- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with plastic edging. Use one piece for full length only.
- D. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
- G. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

## 2.12 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### 3.2 INSTALLATION

- A. Install work in accordance with AWI Custom Quality Standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install components with screws at 12 inch on center.
- E. Install hardware in accordance with manufacturer's instructions.

### 3.3 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

## SECTION 06650

### SOLID POLYMER FABRICATIONS

#### PART 1 GENERAL

##### 1.1 CONDITIONS

- A. Requirements of the Conditions of the Contract and Supplementary Conditions apply to all work under this Section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

##### 1.2 DESCRIPTION

- A. Furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this Section.
- B. The work described in this section of the specifications includes, but is not limited to the following:
  - 1. Vanity tops.
  - 2. Counter top.

##### 1.3 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
  - 1. Metal Fabrications, Section 05500.
  - 2. Finish Carpentry, Section 06220.

##### 1.4 SUBMITTALS

- A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples: Submit minimum 8" x 8" edge detail sample. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for work.

- C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
- D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver no components to project site until areas are ready for installation. Store indoors.
- B. Handle materials to prevent damage to finished surfaces. Provide protective covering to prevent physical damage or staining following installation for duration of project.

#### 1.6 QUALITY CRITERIA

- A. Applicable standards: Standards of the following, as referenced herein:
  - 1. American National Standards Institute (ANSI).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. National Electrical Manufacturers Association (NEMA).
- B. Allowable tolerances:
  - 1. Variation in component size  $\pm 1/8"$  (3 mm).
  - 2. Location of openings:  $\pm 1/8"$  (3 mm) from indicated location.

#### 1.7 WARRANTY

- A. Provide manufacturer's warranty. The manufacturer warrants to the original purchaser of any solid surface product for commercial use that it will be at its option repair or replace, without charge, such product if it fails due to a manufacturing defect during the first 10 years after initial installation. This includes reasonable labor charges needed to repair or replace the product covered hereunder.

This warranty applies to its product that is used and maintained in the manner recommended by its publication: "Caring and Maintenance". A copy may be obtained, free of charge, from the supplier or by writing directly to the manufacturer.

This warranty does not cover damage caused by:

- 1. Failure to follow recommended procedures for fabrication and installation.

2. Physical abuse, damage from excessive heat, or breakage not due to a defect in the manufacture of the material.
3. Failure of any adhesive, caulk, or other accessory, or failure of any caulked or filled joint or seam.  
This warranty applies only to solid surface products specified herein:
4. Purchased after June 1, 1987, for use in the United States or Canada:
5. Which fail due to a manufacturing defect.
6. Which have not been moved from their original place of installation: and
7. The labor charges to repair or replace such products only.  
This warranty is not transferable or assignable.

## PART 2 PRODUCTS

### 2.1 SOLID POLYMER FABRICATIONS

#### A. Acceptable products:

1. Corian - E. I. duPont de Nemours & Company, Inc.
2. Fountainhead - Nevamar Corporation
3. Surell - Formica Corporation

#### B. Material: Cast, filled, acrylic; not coated, laminated or of composite construction, meeting ANSI Z124-1980, Type Six, and Fed. Spec. WW-P-541E/GEN dated August 1, 1980.

1. Material shall have minimum physical and performance properties specified.
2. Superficial damage to a depth of 0.10" (2.5 mm) shall be repairable by sanding or polishing.

#### C. MINIMUM PHYSICAL PROPERTIES OF SOLID SURFACING PRODUCTS

PROPERTY	TEST RESULT	TEST
Tensile Strength	6000 psi	ASTM D638
Tensile Modulus	500,000 psi	ASTM D638
Tensile Elongation	0.3% - 0.8%	ASTM D638
Hardness	90-94 Rockwell M	ASTM D785
Thermal Expansion	5.5 x 10 <sup>-5</sup> in/inEC	ASTM D696
Glass (60E Gardner)	5-20	NEMA-LD3-1980
Color Stability	No change	NEMA-LD3-1980
Abrasion Resistance	Passes	ANSI Z124-1980
Boiling Water Surface Resistance	No visible change	NEMA-LD3-1980
High Temperature Resistance	No change	NEMA-LD3-1980

PROPERTY	TEST RESULT	TEST
Izod Impact	0.25 ft. lbs/in	ASTM D256 (Method A)
Stain Resistance	Passes	ANSI-Z124-1980
Impact Resistance	No fracture	NEMA-LD3-1980
1/4" slab-36" drop		
1/2 lbs ball		
1/2" slab-36" drop		
1 lb ball		
3/4" slab-36" drop		
2 lb ball		
Specific Gravity	1.75 - 1.8 g/cm <sup>3</sup>	ASTM D792A
Water Absorption	24 hrs	ASTM D570
0.04 (3/4" thick)		
0.09 (1/4" thick)		
Flammability		
Flame spread	5 (3/4" thick)	
Smoke Developed	15 (3/4" thick)	
Class I		

- D. Vanity & Counter tops: Tops of solid polymer, thickness as noted on drawing, having edge details as indicated on the drawings. Provide complete with backsplash of size shown on the contract documents.

## 2.2 ACCESSORY PRODUCTS

- A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints.
- B. Sealants: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color matching components.

## 2.3 FABRICATION

- A. Factory fabricate components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawing.
- B. Form joints between components using manufacturer's standard joint adhesive: without conspicuous joints.
- C. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
- D. Cut and finish components edges with clean, sharp returns. Route radii and contours to template.



## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.
- D. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work that cannot be repaired to architect's satisfaction.

END OF SECTION



## SECTION 07120

### FLUID APPLIED WATERPROOFING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Fluid applied rubberized asphalt membrane waterproofing.
- B. Cant strips.
- C. Sub-surface drainage material.
- D. Surface dusting. Protective covering.

##### 1.2 RELATED SECTIONS

- A. Section 02223 - Backfilling.
- B. Section 03300 - Cast-In-Place Concrete: Concrete substrate.
- C. Section 04320 - Veneer Masonry System: Masonry joints prepared to receive flashings.
- D. Section 07160 - Bituminous Dampproofing.
- E. Section 07212 - Board Insulation: Perimeter [and horizontal] insulation [protective cover].
- F. Section 14245 - Hydraulic Elevators - Passenger.
- G. Section 15430 - Plumbing Specialties: Drain flashing flanges.

##### 1.3 REFERENCES

- A. ASTM D412 - Rubber Properties in Tension.
- B. ANSI/ASTM D746 - Brittleness Temperature of Plastics and Elastomeric by Impact.
- C. ASTM C836 - High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course.
- D. ASTM D624 - Rubber Property - Tear Resistance.
- E. ASTM D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.

- F. ASTM D1777 - Method for Measuring Thickness of Textile Materials.
- G. ASTM D2240 - Rubber Property - Durometer Hardness.
- H. ASTM D3468 - Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing.
- I. ASTM D3776 - Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
- J. ASTM D3786 - Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
- K. ASTM D4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc type Apparatus).
- L. ASTM D9491 - Test Methods for Water Permeability of Geotextiles by Permittivity.
- M. ASTM D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
- N. ASTM D4716 - Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
- O. ASTM D4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
- P. ASTM E96 - Water Vapor Transmission of Materials.
- Q. NRCA (National Roofing Contractors Association) - Waterproofing Manual.

#### 1.4 SYSTEM DESCRIPTION

- A. Waterproofing System: Capable of resisting water head of 40 feet (12,000 mm) and prevent moisture migration.

#### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- B. Product Data: Provide data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.

- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

## 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.

## 1.7 QUALIFICATIONS

- A. Waterproofing Material Manufacturer: Company specializing in waterproofing membrane with four years experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.

## 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until liquid or mastic accessories have cured.

## 1.9 WARRANTY

- A. Provide five year warranty.
- B. Warranty: Include coverage for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change of shrinkage is not considered a structural failure.
- C. For warranty repair work, be responsible for removal and replacement of materials concealing waterproofing.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Mameco International, Inc. Product "Vulkem 201H"
- B. Sonneborn Building Products Div ChemRex, Inc. Product "LHM 5000"
- C. Tremco, Inc. Product "Tremproof 60".

## 2.2 MEMBRANE COMPOUND MATERIAL

A. Waterproofing Membrane: ASTM C836; one component elastomeric compound; cold applied, quick setting. 120 mil minimum cured thickness.

B. Cured Membrane Characteristics:

Properties	Test	Results
Tensile Strength:	ASTM D412	150-200 psi
Elongation:	ASTM D412	500 - 600%
Hardness - Shore A:	ASTM D2240	30
Tear Strength:	ASTM D624	less than 35 psi
Moisture Vapor:	ASTM E96	0.09 perms
Low Temperature		
Brittleness:	ANSI/ASTM D746	-40EF

## 2.3 ACCESSORIES

- A. Elastic Flashings: 60 mil (1.5 mm) thick, butyl, as recommended by membrane manufacturer.
- B. Joint Cover Sheet: 60 mil (1.5 mm) thick elastic sheet material designated for and compatible with membrane.
- C. Cant Strips: Premolded composition material manufactured by waterproofing manufacturer.
- D. Joint and Crack Sealant: As recommended by membrane manufacturer.
- E. Back-up Material: As recommended by waterproofing manufacturer.
- F. Reglet Strip Devices: as specified in Section 07620.
- G. Counter Flashings: As specified in Section 07620.

## 2.4 PROTECTIVE MATERIALS

- A. Insulation Board: 2 inch (48 mm) extruded polystyrene compatible with waterproofing membrane as specified in Section 07212, 2.2, A.

## 2.5 SUB-SURFACE DRAINAGE MATERIALS

### A. Manufacturers:

1. Alazo Nobel Geosynthetics Company  
P. O. Box 7249  
Ashville, NC 28801, Phone (704) 665-5050
2. JDR Enterprises, Inc.  
725 Branch Drive  
Alpharetta, GA 30201, Phone (800) 843-7569
3. Nicolon/Mirafi Group  
3500 Parkway Lane, Suite 500  
Norcross, GA 30092, Phone: (800) 234-0484

### B. Composite System:

1. The exterior surface shall have the waterproofing membrane applied to the surface with the insulation board applied directly over it acting as a protection board.
2. The drainage panels are to be placed over a primed insulation board face and shall have a nominal flange along one longitudinal edge to facilitate overlapping the panels in order to achieve a continuous drainage surface. The back (flat side) of the drainage panels are to have a high strength polymeric film adhered to keep the drainage panel from die cutting the insulation board.
3. The filter fabric must be uniformly bonded to each dimple of the polymeric core to resist being pushed into the core flow channels during installation. Application of glue to the composite which results in restriction of flow in the channels will not be accepted. The fabric-to-core bond shall be accomplished by applying a pressure-sensitive resealable adhesive to the tops of the individual dimples.
4. The filter fabric shall extend beyond the polymeric core along one longitudinal edge a minimum of 9" and other edges a minimum of 3" in order to maintain the filtering integrity of the drainage system.

### C. Installation

1. Prior to beginning of the drainage installation, the general contractor shall convene a meeting with the representative of the panel manufacturer and subcontractor involved with the installation.
2. When placing the panel over the waterproofing membrane, use the approved tape or panel adhesive to secure the panel.
3. All connections should be completed in shingle fashion from top to bottom so that moisture will flow with the overlap.
4. The drainage fabric (panels) shall be covered within two (2) weeks of installation.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify substrate surfaces are durable; free of frozen matter, dampness, loose particles, cracks, pits, projections, or foreign matter detrimental to adhesion or application of waterproofing system.
- B. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- C. Verify items which penetrate surfaces to receive waterproofing are securely installed.

### 3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- C. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.
- D. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.

### 3.3 APPLICATION

- A. Apply 12 inch (300 mm) wide strip of joint cover sheet over cracks, non-working joints, and expansion joints over 1/16 inch (1.6 mm) but not exceeding 1/2 inch (13 mm) in width.
- B. Center cover sheet over crack or joints. Roll sheet into 1/8 inch (3.2 mm) coating of waterproofing material. Apply second coat over sheet extending minimum of 6 inches (150 mm) beyond sheet edges.
- C. Apply waterproofing material in accordance with manufacturer's instructions.
- D. Apply and spread waterproofing material to minimum 120 mil (3.05 mm) cured thickness, averaging 100 mil (2.5 mm) in thickness.
- E. Continue waterproofing material up vertical surfaces minimum 6 inches (150 mm) above grade.
- F. Install cant strips at internal corners.



- G. Apply extra thickness of waterproofing material at corners, intersections, angles, and over joints.
- H. Seal watertight, items projecting through waterproofing material.
- I. Extend waterproofing material down to below level of drain. Place filter fabric below pea gravel fill around drainage pipe and wrap over top and run back to face of drainage panel lapping into drainage panel with a 12" sealed lap. Coordinate with drain installation, Section 15430.
- J. Install membrane flashings and seal into waterproofing material.

### 3.4 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over unprotected or uncovered membrane.
- B. Protect waterproofing material from damage by adhering insulation as protection board, applied with compatible adhesive over waterproofing material surface. Apply boards over cooled waterproofing material surface. Scribe and cut boards around projections and interruptions.

END OF SECTION



## SECTION 07160

### BITUMINOUS DAMPPROOFING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Cold applied asphalt bitumen dampproofing.

##### 1.2 RELATED SECTIONS

- A. Section 04311 - Concrete Masonry Units: Masonry surface.
- B. Section 04320 - Veneer Masonry System: Concrete surfaces.
- C. Section 04340 - Reinforced Unit Masonry System: Masonry surfaces.
- D. Section 07212 - Board Insulation: Perimeter and cavity wall construction.

##### 1.3 REFERENCES

- A. ASTM D41 - Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
- B. ASTM D449 - Asphalt Used in Dampproofing and Waterproofing.
- C. ASTM D491 - Asphalt Mastic Used in Waterproofing.
- D. ASTM D2822 - Asphalt Roof Cement.
- E. NRCA (National Roofing Contractors Association) - Waterproofing Manual.

##### 1.4 SUBMITTALS

- A. Product Data: Provide properties of primer, bitumen, and mastics.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

##### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Waterproofing Manual.
- B. Maintain one copy of each document on site.

## 1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum ten (10) years documented experience.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until membrane has cured.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Chem Rex, Inc./Sonneborne Bldg Products Div.: Product Hydrocide 128 Spray Mastic.
- B. Karnak Chemical Corporation: Product 220 AF
- C. Meadows W. R. Meadows, Inc.: Product Solvent-Type, Semi-Mastic.

### 2.2 COLD ASPHALTIC MATERIALS

- A. Asphalt Mastic: ASTM D491.
- B. Asphalt Primer: ASTM D41, compatible with substrate.
- C. Asphalt Cement: ASTM D2822 Type I.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- B. Verify items which penetrate surfaces to receive dampproofing are securely installed.

### 3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

- C. Do not apply dampproofing to surfaces unacceptable to manufacturer or applicator.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

### 3.3 APPLICATION

- A. Prime surfaces in accordance with manufacturer's instructions.
- B. Apply cold bitumen with roller spray application by trowel.
- C. Apply bitumen in two coats, continuous and uniform, at a rate of one gal/100 sq ft per coat.
- D. Seal items projecting through dampproofing surface with mastic. Seal watertight.

END OF SECTION



## SECTION 07191

### VAPOR RETARDERS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Sheet and sealant materials for controlling vapor diffusion.

##### 1.2 RELATED SECTIONS

- A. Section 07213 - Batt Insulation: Insulation.
- B. Section 07900 - Joint Sealers: Sealants.

##### 1.3 REFERENCES

- A. ASTM C920 - Elastomeric Joint Sealants.
- B. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
- C. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

##### 1.4 DEFINITION

- A. Vapor Retarder: A material or assembly of materials that resists water vapor diffusion through it.

##### 1.5 SYSTEM DESCRIPTION

- A. Materials and installation methods to provide continuity of vapor retarder:
  - 1. In conjunction with materials described in Section 07213.
  - 2. To seal gaps between enclosure components and opening frames.

##### 1.6 PERFORMANCE REQUIREMENTS

- A. Maximum Vapor Permeability (Perm): 1 ng/S/m/pa measured in accordance with ASTM E96 Method E.

##### 1.7 SUBMITTALS

- A. Submit under provisions of Division 1.

- B. Product Data: Provide data indicating material characteristics, performance criteria, limitations, and installation methods.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation requirements, techniques.

## 1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation.
- B. Maintain one copy of each document on site.

## 1.9 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this section.

## 1.10 SEQUENCING

- A. Sequence Work to permit installation of materials in conjunction with other retardant materials and seals.
- B. Do not install vapor retarder until items penetrating it are in place.

# PART 2 PRODUCTS

## 2.1 SHEET MATERIALS

- A. Sheet Retarder Type 1 opaque or translucent laminated reinforced membrane film for above grade application, having a maximum perm rating of 1.0; manufactured by the following:
  - 1. Aquabar "B" (30/30/30) for wall construction and Pyro Kure 600 for roof decks, both are products of fortifiber Corporation, 4489 Bandini Blvd., Los Angeles, CA 90023.
  - 2. T-65 for wall construction are products of Griffolyn - Reef Industries, Inc., P. O. Box 750250, Houston, TX 77275-0250, Phone (800) 231-6074.
  - 3. Rufco 300 for walls, a product of Raven Industries, P. O. Box 5107, Sioux Falls, SD 57117-5107, Phone (800) 635-3456.

## 2.2 SEALANTS

- A. Polyurethane Sealant Type S: ASTM C920, Grade NS, Class 25, Use NT; single component, chemical curing, non-sagging; Buff color; Dymeric manufactured by Tremco:



1. Elongation Capability: 25 percent.
2. Service Temperature Range: -40 to 180 degrees F (-40 to 82 degrees C).
3. Shore A Hardness Range: 20 to 35.

- B. Primer: Recommended by sealant manufacturer to suit application.
- C. Cleaner: Non-corrosive type; recommended by sealant manufacturer; compatible with adjacent materials.

## 2.3 ADHESIVES

- A. Mastic Adhesive or Tape: Non-solvent type, compatible with sheet barrier and substrate, thick mastic of uniform consistency.

## 2.4 ACCESSORIES

- A. Thinner and Cleaner for Neoprene Sheet: As recommended by sheet material manufacturer.
- B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide, compatible with sheet material.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify condition of substrate and adjacent materials.

## 3.2 PREPARATION

- A. Remove loose or foreign matter which might impair adhesion.
- B. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturers' instructions.

## 3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Vapor Retarder For Stud Framed Walls: Secure sheet barrier Type 1 to stud faces with adhesive. Lap edges over stud faces, lap ends onto adjacent construction; tape ends with non-solvent adhesive to ensure complete seal.

- C. Vapor Retarder Seal For Openings: Install sheet barrier Type 1 between window and door frames and adjacent vapor retarder and seal with adhesive. Position laps over firm bearing.
- D. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

END OF SECTION

## SECTION 07212

### BOARD INSULATION

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Board insulation at cavity wall construction, perimeter foundation wall and underside of floor slabs.

##### 1.2 RELATED SECTIONS

- A. Section 04320 - Veneer Masonry System.
- B. Section 07213 - Batt Insulation.
- C. Section 07416 - Standing Seam Metal Roof System: Rigid insulation at roof system.

##### 1.3 REFERENCES

- A. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.
- B. ASTM C1013 - Membrane Faced Rigid Cellular Polyurethane Roof Insulation.
- C. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- D. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
- F. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.
- G. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- H. FS: Federal Specifications - HH-I-1972/1 - Insulation Board Thermal Polyurethane or Polyisocyanurate, faced with aluminum foil on both sides of the foam.

##### 1.4 SYSTEM DESCRIPTION

- A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 07416.

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data on product characteristics, performance criteria, and limitations.
- B. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation, and installation techniques.
- C. Manufacturer's Certificate: Certify that products meet or exceed [specified requirements.
- D. Sample: 4" x 4" x 1" thick; two pieces.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Celotex Corp. Product Thermax 610C.
- B. Amoco Foam Product Amofam - CM
- C. Dow Chemical, U.S.A. Product Styrofoam High Load 115

2.2 INSULATION MATERIALS

A. PERIMETER/SLAB INSULATION

Extruded Polystyrene Insulation: ASTM C578 Type V cellular type, conforming to the following:

- 1. Board Density: 3.0 lb/cu ft.
- 2. Board Size: 16 x 96 inch.
- 3. Board Thickness: 3/4 inches.
- 4. Thermal Resistance: R of 5.0 per 1-inch thickness.
- 5. Water Absorption: In accordance with ASTM D2842 0.3 percent by volume maximum.
- 6. Compressive Strength: Minimum 125 psi
- 7. Board Edges: Tongue and groove edges.
- 8. Flame/Smoke Properties: 5 / 165 in accordance with ASTM E84.
- 9. To be used as perimeter foundation wall and underside of slab on grade.

## B. CAVITY WALL INSULATION

Polyisocyanurate Insulation: Closed cell glass fiber reinforced type, conforming to the following:

1. Board Size: 16 x 96 inch.
2. Board Thickness: 2 inches.
3. Facing: Reflective aluminum foil facers.
4. Thermal Resistance: Aged (conditioned R-value as determined by ASTM C 236)R of 7.0 per 1-inch thickness at 75 degree mean temperature.
5. Board Edges: square.
6. Water Absorption: In accordance with ASTM D2842 less than 1 1/2 percent by volume maximum.
7. Flame/Smoke Properties: 20/65 in accordance with UL 723.
9. Having no HCFC's in this product.
8. To be used in the masonry cavity walls.

## 2.3 MANUFACTURERS - ADHESIVES

- A. Amoco Foam Products
- B. Celotex Corporation
- C. Dow Chemical, U.S.A

## 2.4 ADHESIVES

- A. Adhesive Type 1: Type recommended by insulation manufacturer for application.

## 2.5 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch.
- B. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be mechanically fastened to surface to receive board insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place; as recommended by the manufacturer of the insulation.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

- B. Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances that may impede adhesive bond.

### 3.2 INSTALLATION - FOUNDATION PERIMETER

- A. Adhere a twelve inch wide strip of polyethylene sheet over construction joints with double beads of recommended adhesive each side of joint.
  - 1. Tape seal joints.
  - 2. Extend sheet full height of joint.
- B. Apply Type adhesive in three continuous beads per board length to full bed 1/8 inch.
- C. Install boards on foundation wall perimeter, horizontally.
  - 1. Place boards in a method to maximize contact bedding.
  - 2. Stagger side joints.
  - 3. Butt edges and ends tight to adjacent board and to protrusions.
- D. Extend boards over control joints, unbonded to foundation 4 inches on one side of joint.
- E. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.
- F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces, apply adhesive in five continuous beads per board length.
  - 1. Install boards horizontally from base of foundation to top of insulation.
  - 2. Butt board joints tight; stagger from insulation joints.

### 3.3 INSTALLATION - CAVITY WALLS

- A. Secure impale fasteners to substrate at a frequency of 6 per insulation board.
- B. Apply required adhesive in three continuous beads per board length to full bed 1/8 inch thick on substrate. Daub adhesive tight to protrusions to ensure continuity of vapor retarder and air seal.
- C. Install boards horizontally between wall reinforcement vertically.
- D. Place membrane surface against adhesive. Tape seal board joints.
- E. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and no protrusions. Place impale fastener locking discs.
- F. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

### 3.4 INSTALLATION - UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing slab.

### 3.5 PROTECTION OF FINISHED WORK

- A. Do not permit work to be damaged prior to covering insulation.

### 3.6 SCHEDULES

- A. Perimeter Insulation: Type A, extruded polystyrene, bead adhesive application, 1/2 inch thick protection board.
- B. Cavity Wall Insulation: Type B, polyisocyanurate insulation, secured with impaling fasteners.

END OF SECTION





## SECTION 07213

### BATT INSULATION

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Batt insulation in exterior wall construction.

##### 1.2 RELATED SECTIONS

- A. Section 05400 - Cold Formed Metal Framing: Supporting construction.
- B. Section 07212 - Board Insulation.
- C. Section 09260 - Gypsum Board Systems: Acoustical Insulation.

##### 1.3 REFERENCES

- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- C. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.
- D. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

##### 1.4 SYSTEM DESCRIPTION

- A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements and in conjunction with thermal insulating materials in Section 07212.

##### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data on product characteristics, performance criteria, and limitations.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS - INSULATION MATERIALS

- A. Certainteed Corporation - Product Bldg Insulation
- B. Manville - Product C.I. Unfaced
- C. Owens/Corning Fiberglas - Product Thermal Batts

### 2.2 MATERIALS

- A. Batt Insulation:
  - 1. Unfaced type - ASTM C665; preformed glass fiber batt; friction fit, conforming to the following:
    - a. Thermal Resistance: R of 3.14 per 1-inch thickness.
    - b. Batt Size: 6.25 x 96 inch.
    - c. Facing: Unfaced.
    - d. Flame/Smoke Properties: 25/50 in accordance with ASTM E84.
- B. Sheet Vapor Retarder: Clear polyethylene film conforming to ASTM D4397 6.0 mil (0.15 mm) with maximum permeance rating of 018 perms.
- C. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide.
- D. Insulation Fasteners: Steel impale spindle and clip on flat metal base, self adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

### 3.2 INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior walls spaces without gaps or voids. Do not compress insulation. Use steel impale fasteners at all appropriate locations.

- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
- E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- F. Metal Framing: Place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- G. Extend vapor retarder tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

END OF SECTION



## SECTION 07250

### SPRAYED FIREPROOFING

#### PART 1 GENERAL

##### 1.1 CONDITIONS

A. Requirements of the Conditions of the Contract and Supplementary Conditions apply to all work under this Section.

B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

##### 1.2 DESCRIPTION

A. Furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this section.

B. The work described in this section of the specifications includes, but is not limited to the following:

1. Sprayed cementitious fireproofing materials shall be free of all forms of asbestos and asbestos contamination, and manufacturer shall provide certification of same, signed by an officer.

##### 1.3 RELATED WORK

A. The following items of related work are specified and included in other sections of these specifications:

1. Structural Steel, Section 05120.
2. Steel Decking, Section 05300.

##### 1.4 QUALITY ASSURANCE

A. Fireproofing work shall be performed by a firm acceptable to the sprayed fireproofing material manufacturer.

B. Products, execution and fireproofing thicknesses shall conform to the applicable code requirements for the fire-resistance ratings called for.

C. Certification: A manufacturer and Contractor Certification of Completion must be completed and submitted at the end of the project.

## 1.5 REFERENCES

### A. ASTM Standards:

1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. E119 - Standard Methods of Fire Tests of Building Construction and Materials.
3. E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.
4. E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
5. E759 - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members.
6. E760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.
7. E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.
8. E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.
9. E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.
10. G-21-75 Standard test method to evaluate resistance of synthetic polymer materials to fungi.

B. Test Methods for abrasion and impact resistance developed by the City of San Francisco, Bureau of Building Inspection.

C. Underwriters Laboratories, Inc. (UL) Fire-Resistance Directory (Latest Edition).

D. Uniform Building Code Standard No. 43-8: Thickness and Density Determination for Spray-Applied Fireproofing.

## 1.6 SUBMITTAL

A. Manufacturers' Data: Submit manufacturer's instructions for proper application of sprayed fireproofing.

B. Test Data: Laboratory test results for fireproofing shall be submitted for the following performance criteria specified, upon request.

1. Bond Strength per ASTM E736.
2. Compressive Strength per ASTM E761.
3. Deflection per ASTM E759.
4. Bond Impact per ASTM E760.
5. Air Erosion per ASTM E859.
6. Corrosion Resistance per ASTM E937.

7. Abrasion Resistance per City of San Francisco, Bureau of Building Inspection Test Method.
8. Impact penetration per City of San Francisco, Bureau of Building Inspection Test Method.

C. Sample: A sample indicating the finished product, including all prime and finish coats shall be submitted prior to the award of the project. The Owner, Architect, and Contractor shall approve prior to award.

## 1.7 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered in original unopened packages, fully identified as to manufacturer, brand or other identifying data, and bearing the proper Underwriters' Laboratories, Inc. labels for fire hazard and fire-resistance classification.

B. Material shall be stored (above ground), under cover and in a dry location until ready to use. All bags that have been exposed to water before use shall be found unsuitable for use and discarded. Stock of material is to be rotated and used prior to its expiration date.

## 1.8 PROJECT/SITE CONDITIONS

A. A minimum temperature of 40°F (4.4°C) for air and substrate must be maintained for 24 hours before, during and for 24 hours after application of the sprayed fireproofing. If necessary for job progress, General Contractor shall provide enclosures with heat to maintain temperatures.

B. General Contractor shall provide ventilation to allow for proper drying of the fireproofing during and subsequent to its application. In poorly ventilated areas lacking natural ventilation, forced air ventilation shall be employed to achieve a total air exchange rate of 4 times per hour until the material is substantially dry.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. The sprayed fireproofing material shall be a cementitious inorganic fireproofing, as manufactured by the Construction Products Division of W.R. Grace & Co., or Carbolite, Fireproofing Products Div., 350 Hanley Industrial Ct., St. Louis, MO.

### 2.2 MATERIALS

A. Materials shall be Monokote Type MK-6/CBF or Type MK-6/ED factory-blended cementitious fireproofing, applied to provide compliance with all drawings, specifications and the following performance test criteria.

1. Dry Density: The field density shall be measured in accordance with ASTM Standard E605. Minimum average density shall be that listed in the UL Fire-Resistance Directory, ICBO Evaluation Report or as required by the authority having jurisdiction.
2. Deflection: Material shall not crack or delaminate from the surface to which it is applied when tested in accordance with ASTM E759.
3. Bond Impact: Material subject to impact tests in accordance with ASTM E760 shall not crack or delaminate from the surface to which is applied.
4. Bond Strength: Fireproofing, when tested in accordance with ASTM E736 shall have a minimum average bond strength of 200 psf and a minimum individual bond strength of 150 psi.
5. Air Erosion: Maximum allowable weight loss of the fireproofing material shall be 0.005 gm/ft.2 when tested in accordance with ASTM E859.
6. Compressive Strength: The fireproofing shall not deform more than 10% when subjected to compressive forces of 1000 psf when tested in accordance with ASTM E761.
7. Corrosion Resistance: Steel with applied fireproofing shall be tested in accordance with ASTM E937 and shall not promote corrosion of steel.
8. Abrasion Resistance: No more than 15 cm<sup>3</sup> shall be abraded or removed from the fireproofing substrate when tested in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection, and required by the U.S. Navy (NAVFAC).
9. Impact Penetration: The fireproofing material shall not show a loss of more than 6 cm<sup>3</sup> when subjected to impact penetration tests in accordance with the test methods developed by the City of San Francisco, Bureau of Building Inspection, and required by the U.S. Navy (NAVFAC).
10. Surface Burning Characteristics: Material shall exhibit the following surface burning characteristics when tested in accordance with ASTM E84. Flame Spread 0  
Smoke Development 0

B. MK-6/CBF may be used on all structural steel members (beams, columns, joists, trusses etc.) and on fluted steel decking MK-6/ED and Spatterkote are to be used on all flat plates cellular decking. MK-6/ED is optional on other surfaces.

C. The sprayed fireproofing material shall have been tested and reported by Underwriters Laboratories, Inc. in accordance with the procedures of ASTM E119. D. Sprayed fireproofing material and application shall meet requirements of U.S. O.S.H.A. regulation 29 C.F.R. Section 1926.55 (c), which regulates the use of asbestos in construction and shall be free of mineral wool.

E. Mixing water shall be clean, fresh and suitable for domestic consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material.

F. The fireproofing product shall be tested in accordance with ASTM Standard G-21-75, and shall show resistance to mold growth when inoculated with aspergillus niger, and mixed spore cultures. (Tappi T487-M54 and ASTM G-21-80). Mold inhibitor shall be added by the manufacturer.



## PART 3 EXECUTION

### 3.1 PREPARATION

A. All surfaces to receive sprayed fireproofing shall be free of oil, grease, paints/primers, loose mill scale, dirt or other foreign substances which may impair proper adhesion of the fireproofing to the substrate. Where necessary, cleaning of surfaces to receive fireproofing shall be the responsibility of the Structural Steel Erector, or General Contractor, as outlined in the structural steel or steel deck section.

B. Prior to application of fireproofing, clips, hangers, support sleeves and other attachments required to penetrate the fireproofing shall be in place.

C. Ducts, piping, equipment or other suspended matter which would interfere with application of fireproofing materials shall not be positioned until fireproofing work is complete.

D. Prior to application of the fireproofing to the underside of roof decks, all roofing applications shall be completed. All roof traffic shall be prohibited upon commencement of the fireproofing application and until the fireproofing material is cured and fully dried.

E. Prior to application of the fireproofing to the underside of steel decking, concrete work above shall be complete.

F. Provide masking, drop cloths or other satisfactory coverings so as to prevent overspray of sprayed fireproofing.

G. Monokote is slippery when wet. The General Contractor and Applicator shall be responsible for posting appropriate cautionary SLIPPERY WHEN WET signs. Signs shall be posted in all areas in contact with wet fireproofing material. In addition, the General Contractor shall be responsible for appropriate barriers to prevent entry by non-fireproofing workers into the fireproofing spray and mixer areas or other areas exposed to wet fireproofing material. H. Application of sprayed fireproofing shall not begin until the General Contractor and the Fireproofing Applicator have inspected the surfaces to receive fireproofing to determine if surfaces are acceptable to receive the fireproofing material. Where a primer is specified and mechanical attachments are required to obtain the fire- resistance rating, the General Contractor shall be responsible for installation of such attachments before the fireproofing is begun.

### 3.2 APPLICATION

A. Equipment and application procedure shall conform to the material manufacturer's application instructions.

B. Monokote Accelerator may be used as a field application aid for Monokote and Retro-Guard fireproofing.

C. A discontinuous textured spray of W.R. Grace & Co. Spatterkote shall be applied to all cellular steel floor units with flat plate on the bottom. Before application of the Monokote fireproofing, Spatterkote material shall be applied in accordance with manufacturer's application instructions.

D. All patching and repairing of sprayed fireproofing, due to damage by other trades, shall be performed under this section and paid for by the trade(s) responsible for the damage.

### 3.3 FIELD QUALITY CONTROL

A. The Resident Engineer may select, and the Owner will pay an independent testing laboratory to sample and verify the thickness and density of the fireproofing in accordance with provisions of ASTM E605. "Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members", the "Inspection Procedure for Field-Applied Sprayed Fire Protection Materials" as published by the AWCI, or Uniform Building Code Standard No. 43-8 entitled "Thickness and Density termination for Spray-Applied Fireproofing".

B. The results of the above tests shall be made available to all parties at the completion of each floor.

### 3.4 CLEANING

A. After the completion of fireproofing work, application equipment shall be removed. Except as detailed; walls, floor and other surfaces are to be left in a scraped clean condition.

### 3.5 SCHEDULE

A. Fire-Resistance Rating (time in hours) schedule shall be as indicated on the contract documents.

END OF SECTION

## SECTION 07270

### PENETRATION SEALS

#### PART 1 GENERAL

##### 1.1 CONDITIONS

- A. Requirements of the Conditions of the Contract and Supplementary Conditions apply to all work under this Section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

##### 1.2 DESCRIPTION

- A. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floors, walls, and other elements of construction.

##### 1.3 RELATED WORK

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections including:
  - 1. Section 07900 - Caulking and Sealants
  - 2. Section 09250 - Gypsum Drywall
  - 3. Division 15 and 16 Sections - Mechanical, Electrical, and Plumbing Work

##### 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Two years experience installing UL classified fire stopping.
- B. Performance: Materials shall have been tested to provide fire rating equal to that of the construction.

##### 1.5 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.

2. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications.

B. Manufacturer's Data:

Submit copies of manufacturer's specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

- C. Applicator's Qualifications Statement: List past projects indicating required experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, grade, and UL label where applicable.
- B. Coordinate delivery with scheduled installation date to allow minimum storage time at site.
- C. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

## 1.7 PROJECT CONDITIONS

A. Existing Conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental Requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

## 1.8 GUARANTEE

- A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following manufacturers as further defined in the Systems and Applications Schedule in Part 3 of this section.

### 2.2 MATERIALS

- A. Provide materials classified by UL to provide Fire Barrier equal to time rating of construction being penetrated.
- B. Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

### 3.2 INSTALLATION

- A. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with manufacturer's instruction.
- B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
- C. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- D. Protect materials from damage on surfaces subject to traffic.

### 3.3 FIELD QUALITY CONTROL

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

### 3.4 ADJUSTING AND CLEANING

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.
- C. Remove equipment, materials and debris leaving area in undamaged, clean condition.

### 3.5 SYSTEMS AND APPLICATION SCHEDULE: (Use system that best matches the wall and floor construction) Construction Condition UL Designation

- A. Metal Pipe or Conduit Through Round Opening 49, 95, 138, 202
- B. Insulated Metal Pipe Through Round Opening 91, 152, 203
- C. Metal Pipes or Conduits Through Large Opening 63, 93, 94, 137 233, 234
- D. Busway Through Rectangular Opening 97, 99
- E. Cables Through Opening 33, 65, 140, 204
- F. Cable Tray 66, 105, 139
- G. Glass Pipe Through Opening 90, 212
- H. Blank Opening 61, 62, 92, 102, 104, 136, J900B, U900J
- I. Non-metallic (Plastic) Pipe or Conduit Through Opening 64
- J. Metal Pipe or Conduit Through Gypsum Board Wall 147
- K. Metal Pipe or Conduit Through Gypsum Board Wall 148
- L. Cables Through Gypsum Board Wall 149
- M. Insulated Metal Pipe Through Gypsum Board Wall 147
- N. Glass Pipe Through Gypsum Board Wall 154, 211
- O. Metal Pipe or Conduit Through Wood Construction 159, 169
- P. Non-metallic (Plastic) Pipe or Conduit Through Wood 160, 167 Construction
- Q. Cables Through Wood Construction 168

END OF SECTION

## SECTION 07416

### SEAM METAL ROOF SYSTEM (STANDING SEAM METAL ROOF SYSTEM)

#### PART 1. GENERAL

##### 1.1 SECTION INCLUDES

- A. Precoated galvanized steel roofing and associated integral flashings.
- B. Integral gutters and downspouts.
- C. Snow guards
- D. Integral fascias

##### 1.2 RELATED SECTIONS

- A. Section 05120 - STRUCTURAL STEEL
- B. Section 05210 - STEEL JOIST
- C. Section 05311 - STEEL ROOF DECK
- D. Section 07212 - BOARD INSULATION: Rigid insulation under sheet metal roofing system.
- E. Section 07900 - JOINT SEALER.

##### 1.3 REFERENCES

###### ALUMINUM ASSOCIATION (AA)

AA ASD-1 (1990) Aluminum Standards and Data

AA SAS-30 (DEC 1986; 5th Ed.) Aluminum Construction Manual Series -  
Section C-1 Specifications for Aluminum Structures

###### AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673 (1986; Addenda 1989; Errata Nov 30, 1990) Cold-Formed Steel  
Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 446	(Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 463	(1988) Steel Sheet, Cold-Rolled Aluminum-Coated, Type 1 and Type 2
ASTM A 792	(1989) Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B 117	(1990) Salt Spray (Fog) Testing
ASTM B 209	(1990) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM D 522	(1988) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989) Specular Gloss
ASTM C 665	(1991) Std. Spec for Mineral Fiber Blanket Thermal Insulation for Light Frame Const. and Manufacturing Housing
ASTM D 714	(1987) Evaluating Degree of Blistering of Paints
ASTM D 968	(1981; R 1991) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1979a; R 1984) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1989) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1987) Testing Water Resistance of Coatings in 100 Percent Relative Humidity
ASTM D 2794	(1990) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1990) Measuring Adhesion by Tape Test



- ASTM D 4214 (1989) Evaluating the Degree of Chalking of Exterior Paint Films
- ASTM D 4397 (1984; R 1989) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
- ASTM E 84 (1991a) Surface Burning Characteristics of Building Materials
- ASTM E 96 (1992) Water Vapor Transmission of Materials
- ASTM E 283 (A90) Air Infiltration
- ASTM E 331 (1990) Water Infiltration
- ASTM E 1592 Panel System to withstand load
- ASTM G 23 (1990) Operating Light-Exposure Apparatus (Carbon-Arc Type) with and without Water for Exposure of Nonmetallic Materials
- AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
- ASCE 7 (1988) Minimum Design Loads for Buildings & Other Structures
- FEDERAL SPECIFICATIONS (FS)
- FS HH-I-1972 (1981; R1991) Insulation Board, Thermal Faced, Polyurethane or Polyisocyanurate
- METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)
- MBMA-01 (1986; Errata; Supple 1990) Low Rise Building Systems Manual
- UNDERWRITERS LABORATORIES (UL)
- UL 580 (1988, Rev through Dec 1 1989) Test for Uplift Resistance of Roof Assemblies

#### 1.4 MANUFACTURER

- A. Standing seam metal roof system (SSMRS) shall be the product of a recognized SSMRS manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 3 years and has been involved in at least 5 projects similar in size and complexity to this project.
1. A representative of the SSMRS manufacturer, who is familiar with the design of the standing seam metal roof system supplied and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation of the SSMRS to assure that the roof system meets the specified requirements.

The manufacturer's representative shall be an employee of the manufacturer with at least two years experience in installing the roof system that is certified by the SSMRS manufacturer to have two years of experience installing similar roof systems.

2. Installer: The installer shall have a minimum of 2 years experience and shall have been involved in installing at least 3 projects that are of comparable size, scope and complexity as this project for the particular roof system furnished.

## 1.5 DESIGN REQUIREMENTS

- A. The SSMRS shall be designed by the Manufacturer as a complete system. Members and connections not indicated on the drawings shall be designed by the Manufacturer.
  1. Design Conditions: Loading criteria shall be in accordance with ASCE 7 unless otherwise specified. The structural section properties used in the design of the framing members shall be determined using the unloaded shape of the roof panels. Roof panels, components, transitions, and assemblies shall be the products of the same manufacturer. There shall be a minimum of two fasteners per clip; single fasteners will be allowed when the supporting structural members are prepunched or predrilled.
  2. Dead Load: The design dead load shall be the actual weights of the SSMRS components as determined by the manufacturer.
  3. Concentrated Loads: The panels and concealed anchor clips shall be capable of resisting a 200-pound concentrated load at midspan on a 12-inch wide section of deck. The panels shall support the combined dead load and concentrated load without buckling or permanent distortions; and the panel deflection shall not exceed 1/180th of the span between supports.
  4. Live Loads: The design live loads shall be the roof snow loadings given on the drawings.
  5. Wind Uplift Loads: The design uplift pressures for the roof system shall be computed and applied using a basic wind speed of 80 miles per hour (fastest mile). The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the safety factor of 2.25 when two or more fasteners are in each connection.

6. Thermal Loads: Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total 200 degree temperature range during the life of the structure.
7. Framing Members: Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI SG-673. Maximum deflection under applied dead load plus live load and/or wind load for subpurlins shall not exceed 1/240 times the span length and shall be based on constraint conditions at the supports.
8. Roof Panels: Steel panels shall be designed in accordance with AISI SG-673. The panel deflection under applied dead load plus live load and/or wind load shall not exceed 1/180 times the span between supports; deflections shall be based on panels being continuous across two or more supports, the specified fastener spacing, and the ability of the panel to rotate freely on the support.
9. Accessories and Fasteners: Accessories shall be capable of resisting the specified design wind uplift loads and shall allow for movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. The uplift resistance of the SSMRS shall be in strict accordance with performance testing which shows UL 580; I-90 classification approval for all system components, fastening devices, and completed assembly applied to metal deck and/or supporting structural roof framing members.

#### 1.7 SUBMITTALS: The following shall be submitted in accordance with Division 1 SUBMITTAL DESCRIPTIONS:

- A. Design Analysis: Design analysis signed by a Registered Professional Engineer, prior to beginning of manufacture. The design analysis shall include, but not be limited to, the following wind and thermal information:
  1. Wind forces on various parts of the roof. Both positive and negative pressures shall be calculated with the controlling pressure summarized.
  2. Thermal movements that will result from the specified temperature range.
- B. Calculation: The calculations shall be accompanied by details from the manufacturer that demonstrate how installed concealed anchor clips and other roof system devices will accommodate the required thermal movement.

- C. Shop Drawings: Standing Seam Metal Roof System submittal shall include Contractor's drawings and specifications; design and erection drawings, shop coating and finish specs; samples, guarantees; and other data as necessary to clearly describe design materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealant(s) and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's products and fabricated items as required. Manufacture proprietary shall review and approve shop drawings for compliance with proprietary products and fabricated items prior to submission of shop drawings to the Contracting Officer.
- D. Qualifications:
- Copy of current qualifications and experience of the SSMRS installer and field representative.
- E. Tests: UL 580 classification I-90 identification listing member and test report for uplift resistance of the SSMRS.
- F. Certificates: Standing Seam Metal Roof System.
1. Certification that the actual thickness of uncoated steel sheets used in SSMRS components including roofing panels, subpurlins, and concealed anchor clips comply with specified requirements.
  2. Certification that the sheets to be furnished are produced under a continuing quality control program have been listed and have met the quality standards specified for factory color finish.
  3. Mill certification for structural bolts and roof panels.
- G. Samples:
1. Accessories: One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.
  2. Roof Panels: One piece of each type to be used, 9 inches long, full width.
  3. Fasteners: Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

4. Insulation: One piece, 12 inches by 12 inches, of each type and thickness to be used, and descriptive data.
5. Gaskets and Insulating Compounds: Two samples of each type to be used and descriptive data.
6. Sealant: One sample, approximately 1 pound, and descriptive data.
7. Concealed anchor clip: Two samples of each type used.
8. Subpurlins: One piece, 9 inches long.
9. EPDM rubber boots: One piece of each type.

#### 1.8 MOCKUP

- A. Provide mockup of standing seam metal roof system; eight feet (2.4m) long by 4 feet (1.22m) wide, which includes associated attachments, flashings, joints and junctions, control or expansion joints, terminating item (edge condition at roof edge.)
- B. Locate where directed.
- C. Mockup may not remain as part of the Work.

#### 1.9 DELIVERY AND STORAGE

- A. Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for roof covering shall provide good air circulation and protection from surface staining.

#### 1.10 GUARANTEE

##### A. Warranties

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

##### B. Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by ordinary exposure to the elements and service design loads, water leaks, and wind uplift damage. The SSSMR system covered

under this warranty shall include the entire roofing system including, but not limited to, the following: panel seams and joint, all accessories, components and trim; penetrations such as vents, curbs, and skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed to provide a weathertight roof system; and items specified in other sections of these specifications that become part of the structural standing seam metal roof system. All material and workmanship deficiencies, system deterioration caused by ordinary exposure to the elements and service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor may supplement this warranty with written warranties from the installer and/or manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached example WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility or the date the Government takes possession, whichever is earlier. It is required that the contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the contractor's warranty responsibilities effective throughout the five year contractor's warranty period for the entire SSSMR system as outlined above.

C. Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

1. A manufacturer's 20 year material warranty warranting that the zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.
2. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying

version of the specified finish or replacing the defective coated material.

~~The SSMRS manufacturer in conjunction with the General Contractor shall be guaranteed for 20 years against leakage arising out of or caused by ordinary wear and tear by the elements. The SSMRS shall also be guaranteed for 20 years against paint finish deterioration beyond limits set forth for the factory color finish. The roof guarantee shall be valued based on the original cost of installing the roof including installation and materials. Such guarantee shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.~~

## PART 2. PRODUCTS

### 2.1 MANUFACTURER AND PROFILE

A. Subject to compliance with requirements, provide products of one of the following:

1. A-E-P Span; Span-Lok SL318/SL216 Profile
2. Butler; VSR Profile
3. Carlisle Engineered Metals
4. Fabral; Stand'N Seam Profile
5. MBCI; Batten Lok Profile
6. Morin Corporation; SSR16/18 Profile

### 2.2 PANELS

A. Roof Panels shall be steel and shall have a factory color finish. The SSMRS assembly shall be Class 90 as defined in UL 580. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when such slope is 30 feet or less. When length of run exceeds 30 feet sheets longer than 30 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSMRS with roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 2 inches. All sheets shall be either square-cut or miter-cut except that gable end wall sheets may be cut in the shop to correspond to the roof slope and may have a horizontal joint at the eave line.

1. Steel Panels: Zinc-coated steel conforming to ASTM A 446, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 65. Panels shall be 22 gauge thick minimum, except that when the mid field of the roof is subject to design wind uplift pressures of 60 psf or greater the entire roof system shall have a minimum thickness of 0.030-inch.
2. Soffit Panels: Prefinished, 24 gage steel panels ASTM A 792. Soffit panels shall be manufactured by the roof panel manufacturer.
3. Flashings and Trim: Prefinished, 24 gage steel panels ASTM A792.

## 2.3 FACTORY COLOR FINISH

- A. Roof panels shall have a factory color finish on the exposed side. The exterior finish shall consist of a 70 percent resin polyvinylidene fluoride coating. Color of the roof panels shall be equal to Northshore Sheet Metal's "Forest Green". The color of the soffits shall be equal to Northshore Sheet Metal's "Parchment". The dry film thickness of the exterior coating shall be not less than 0.8 mil over a primer coat with a dry film thickness of 0.27 mils. The interior color finish shall consist of a backer coat with a dry film thickness of 0.5 mil. The exterior color finish shall meet the test requirement specified below. The manufacturer shall have conducted tests on previously manufactured sheets of the same type and finish as proposed for the project. The term "appearance of base metal" refers to the metal coating on the steel base metal.
  1. Salt Spray Test: A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of 10, no blistering, as determined by ASTM D 714; and rating of 10, no edge creep failure at scribe, as determined by ASTM D 1654.
  2. Formability Test: When subjected to a 180-degree bend over a 3/8-inch diameter mandrel in accordance with ASTM D 522, exterior coating film shall show no evidence of fracturing to the naked eye.
  3. Accelerated Weathering, Chalking Resistance and Color Change: A sample of the sheets shall withstand a weathering test a minimum of 2000 hours in accordance with ASTM G 23 using a Type D apparatus or 500 minimum hours using type EH apparatus. No peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal shall be present. After the 2000 hour weatherometer test, exterior coating color



change shall not exceed 5 color difference units in accordance with ASTM D2244 and chalking shall be less than NO. 8 rating.

4. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.
5. Impact Resistance: Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.
6. Abrasion Resistance Test: When subjected to the falling sand test in accordance with ASTM D 968 the coating system shall withstand a minimum of 50 liters per mil of sand before the appearance of the base metal.
7. Specular Gloss: Finished surfaces shall have a specular gloss of 25 to 35 at an angle of 60 degrees when measured in accordance with ASTM D 523.
8. Pollution Resistance: Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

## 2.4 ACCESSORIES

- A. Accessories shall be compatible with the covering furnished. Flashing, trim, downspouts, gutters, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roofing panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be as recommended by the manufacturer.

## 2.5 FASTENERS

- A. Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear strength of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer

material shall be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8-inch thick.

1. Screws: Screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.
2. Bolts: Bolts shall be not less than 1/4-inch diameter, shouldered or plain shank as required, with locking washers and nuts.
3. Structural Blind Fasteners: Blind screw-type expandable fasteners shall be not less than 1/4-inch diameter. Blind (pop) rivets shall be 9/32-inch minimum diameter.

## 2.6 INSULATION

- A. Roof insulation shall be a closed cell poly-isocyanurate rigid insulation board faced on both sides with aluminum foil conforming to FS HH-I-1972 and FS HH-I-1972/1, Class 2. The R-value is to be 30, maximum of 4-inches thick. Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be an established aged value at 5 years, determined at 75 degrees F in accordance with ASTM C 518. Insulation shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84; shall be a standard product of a manufacturer, factory-marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation shall have a facing providing a permeability of 1.0 perm or less when tested in accordance with ASTM E 96. Facing shall be 1.0 mil thick aluminum foil laminate. Reinforced foil with a natural finish may be used for facing in concealed locations. Facings and finishes shall be factory applied. Insulation shall contain the highest practicable percentage of recovered material which has been diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided.

## 2.7 CONCEALED ANCHOR CLIPS

- A. Concealed anchor clips shall be stainless steel and have factory punched or drilled holes for attachment. Clips used with panel width greater than 12 inches shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip.

## 2.8 SEALANT

- A. Except as stated below, sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall cure to a rubberlike consistency. All sealants shall be the nonhardening type. Roof panel standing seam ribs shall have a continuous sealant that is factory installed.

## 2.9 GASKETS AND INSULATING COMPOUNDS

- A. Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

## 2.10 VAPOR RETARDER

- A. Vapor retarder material shall be polyethylene sheeting conforming to the requirements of ASTM D 4397. A fully compatible tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A general purpose tape which has some resiliency and cushioning abilities shall also be provided.

## 2.11 EPDM RUBBER BOOTS

- A. Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

## 2.12 FACTORY FINISHED METAL PANEL SOFFITS

- A. Where soffits of metal are required, use concealed fastener panel (CFP) of 12" in width having one stiffening bead. Panels shall have a minimum thickness of 22 gage (0.030") maximum length shall be manufacturer's standard. Panels final thickness will be determined by local wind pressures. Depth of panels shall be 1-1/2".

# PART 3. EXECUTION

## 3.1 INSTALLATION

- A. Installation shall be in accordance with the approved erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever covering sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Improper or mislocated drill holes

shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

1. **Roof Panel Installation:** Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. For required field seals (other than noted above in 2.8A), the method of applying joint sealant shall conform to the manufacturer's recommendation as needed to achieve a complete weather-tight installation. End laps, when approved by the Contracting Officer, shall be made over framing members. Closures, flashings, EPDM rubber boots and related accessories shall be installed according to the drawings. Fasteners shall not puncture covering sheets except as approved for flashing, closures, and trim. Exposed fasteners shall be installed in straight lines and shall be permitted only at the rakes, eaves, panel splices, and where required for the attachment of flashings, gutter and other similar accessories.
2. **Concealed Anchor Clips:** Roof panels shall be fastened to framing members with concealed fastening clips or other concealed devices. Clips shall be attached to the building structural system or to the metal deck with bolts or screws. The maximum distance between clips, and the spacing and type of fasteners shall conform with UL580 Class I-90 performance requirements for the specific system to be installed on the project. In no case shall that distance be greater than 5 feet on center.

### 3.2 INSULATION INSTALLATION

- A. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.
  1. **Board Insulation:** Joints shall be tight and sealed as required by the manufacturer.

### 3.3 VAPOR RETARDER INSTALLATION

- A. General purpose tape shall be installed over all the seams of the structural roof decking at any penetrating edges, and at all surface areas exhibiting sharp burrs or similar protrusions. A single ply of 10 mil polyethylene sheet or, at the Contractor's option, a double ply of 6 mil polyethylene sheet shall be installed over the entire deck surface. Tape shall be used to seal the edges of the sheets to the decking, to the edge of the roof supporting structures, or to the sheet below.

Sheet edges shall be lapped not less than six inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with the tape.

### 3.5 CLEANING AND TOUCH-UP

- A. Exposed SSMRS shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch up paint.

END OF SECTION

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## SECTION 07465

### PREFORMED METAL SIDING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Preformed metal siding system for walls, with insulation, liners, related flashings and accessory components.
- B. Building paper back-up over sheathed walls.
- C. Metal soffits where required.

##### 1.2 RELATED SECTIONS

- A. Section 05120: Structural Steel: Structural steel building frame.
- B. Section 05400 - Cold Formed Metal Framing: Stud wall framing system.
- C. Section 09260 - Gypsum Board System: Building paper back-up.
- D. Section 07213 - Batt Insulation.
- E. Section 08520 - Aluminum Windows.

##### 1.3 REFERENCES

- A. ASTM A167 - Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
- B. ASTM A446/A446M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- C. ASTM A525/A525M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
- D. ASTM A606 - Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, with Improved Corrosion Resistance.
- E. ASTM A755/A755M - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil Coating Process For Exterior Exposed Building Products.

- F. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

#### 1.4 SYSTEM DESCRIPTION

- A. System: Preformed and prefinished metal siding system of vertical profile; site assembled; with subgirt framing assembly.

#### 1.5 DESIGN REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with local code and to a design pressure of 30 lb/sq ft (1.44 kPa).
- B. Maximum Allowable Deflection of Panel: 1/180 of span.
- C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 07213.

#### 1.6 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage and vertical lines of siding alignment with the standing seams of the roof panels.
- B. Samples: Submit two samples of siding, finish, 12 x 24 inch (304.8 x 610 mm) in size illustrating finish color, sheen, and texture. Provide sample of preformed metal siding and attachment devices.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum six years documented experience and approved by manufacturer.



## 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Transport, handle, store, and protect products.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials which may cause discoloration or staining.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. I.B.P., Inc. - Industrial Building Panels  
1090 Chicago Rd., Troy, Michigan 48083  
810-588-4710 IPB's 504 at 18 gauge
- B. Robertson, 400 Holiday Drive  
Pittsburgh, PA 15220  
412-928-7500 Series IW-10A at 18 gauge
- C. Smith Steelite, 1005 Beaver Grade Rd,  
Moon Township, PA 15108-2944  
800-759-7474 Series CFP 111 (18 gauge)

### 2.2 EXTERIOR SHEET MATERIALS

- A. Precoated Galvanized Steel: ASTM A755/A755M; ASTM A446/A446M, Grade A, Coating Designation G90; shop precoated with polyvinyl fluoride (PVF) coating.  
Exposed Exterior Surfaces: PVF2 color as selected from manufacturer's standard range.

### 2.3 INSULATION

- A. Insulation: Glass fiber type specified in Section 07213; thermal resistance R of 19 (RSI of 3.34).

### 2.4 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; color as selected.

- B. Sealants: Manufacturer's standard type suitable for use with installation of system; non-staining, skinning, non-shrinking and non-sagging; ultra-violet and ozone resistant. Color to match the metal siding.
- C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, stainless steel; fastener cap same color as exterior panel. Exposed fasteners same finish as panel system.
- D. Field Touch-up Paint: As recommended by panel manufacturer.
- E. Building Paper: ASTM D226, 15 pound (73 kg/sq m) unperforated asphalt felt.

## 2.5 COMPONENTS

- A. Exterior Sheet: Minimum 22 gage (.76 mm) thick precoated steel stock profile as indicated; 12 inches (304.8 mm) wide panel; interlocking edges, fitted with continuous gaskets filled with sealant.
  - 1. Where soffits of metal are required, use concealed fastener panel (CFP) of 12" in width having one stiffening bead. Panels shall have a minimum thickness of 22 gage (0.030") maximum length shall be manufacturer's standard. Panels final thickness will be determined by local wind pressures. Depth of panels shall be 1-1/2".
- B. Subgirts: Minimum gauge of subgirts shall be no less than 20 gauge. Final gauge to be determined by manufacturer of metal panels based on local wind loading conditions.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles. Mitered internal corners to be back braced with 18 gage (1.2 mm) thick precoated sheet stock to maintain continuity of profile.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; 18 gage, 1.2 mm thick; infill type to suit system.
- E. Trim, Closure Pieces, Caps, Flashings, and Facias Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- F. Anchors: Galvanized steel.

## 2.6 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.

- C. Form panels for standing seams.
- D. Fabricate corners in one continuous piece with minimum 18 inch (450 mm) returns.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that framing members are ready to receive panel system.

#### 3.2 INSTALLATION - BUILDING PAPER

- A. Install 1 layers building paper horizontally on walls to receive metal siding.
- B. Weather lap edges 6 inches (150 mm) and ends minimum 6 inches (150 mm), minimum.
- C. Stagger vertical joints of each layer.
- D. Securely staple in place.

#### 3.3 INSTALLATION

- A. Install metal siding system on walls in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten siding to structural supports; aligned, level, and plumb.
- D. Locate joints over supports. Lap panel ends minimum 2 inches (50 mm).
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners unless otherwise approved by Architect/Engineer.
- G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

#### 3.4 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6 mm).

### 3.5 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

## SECTION 07620

### SHEET METAL FLASHING AND TRIM

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Reglets, pitch pockets, sill, and lintel, flashings.
- B. Scuppers, gutters, and downspouts.
- C. Counterflashings over bituminous, or EPDM base flashings.
- D. Counterflashings for roof hatches.
- E. Counterflashings at roof mounted equipment and vent stacks.
- F. Spring type Flashing System, a manufactured product.
- G. Lead sheets where indicated.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 04320 - Veneer Masonry: Placement of flashing reglets and accessories.

##### 1.3 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Wood blocking for metal roofing substrate profiles.
- B. Section 07724 - Roof Hatches.
- C. Section 07900 - Joint Sealers.
- D. Section 06114 - Wood Blocking and Curbing: Roof curbs for mechanical equipment.

##### 1.4 REFERENCES

- A. ASTM B209 - Aluminum and Alloy Sheet and Plate.
- B. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- C. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

- D. NRCA (National Roofing Contractors Association) - Roofing Manual.
- E. SMACNA - Architectural Sheet Metal Manual.
- F. FS QQ-L-201 - (Rev. F; AM2) Lead Sheet, Grade Cor D, hard, containing not less than 4 percent

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- B. Samples: Submit two samples, 8 x 8 inch in size illustrating typical seam, external corner, internal corner, junction to vertical dissimilar surface, material and finish and metal finish color.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA NRCA standard details and requirements.

1.7 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal flashing work with six years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, weathertight, ventilated areas until immediately before installation.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy, temper; 0.050 inch thick; plain finish, shop pre-coated with polyvinylidene fluoride (PVF2) conforming to AAMA 605.2 coating.

Color as selected to match the standing seam metal roof.

- B. Lead sheets where indicated shall be 4 lb (1.8 kg) lead of 1/16 inch (1.6mm) thickness.

## 2.2 ACCESSORIES

- A. Fasteners: Aluminum Same material and finish as the sheet metal, with soft neoprene washers.
- B. Primer: Zinc chromate.
- C. Protective Backing Paint: Zinc chromate alkyd.
- D. Sealant: Polyurethane type, specified in Section 07900.
- E. Bedding Compound: Rubber-asphalt.
- F. Plastic Cement: ASTM D4586, Type I.
- G. Reglets: Surface mounted with counterflashing constructed of aluminum 0.025" thick; finish epoxy coated.
- H. Gutter and Downspout Anchorage Devices: SMACNA requirements. Type recommended by fabricator. Finish: Sec 2.1 Para A, this section of specifications.
- I. Gutter Supports: Brackets, Straps, Spikes and ferrules. Finish of gutter support - same as gutter and downspours.
- J. Downspout Supports: Brackets Straps. Finish same as downspouts.
- K. Sprinklok Flashing System shall be Type "MA" as manufactured by Fry Reglet Corporation, 625 So. Palm Avenue, Alhambra, CA 91803. Reglet and flashing shall be made of aluminum of .025 with thick with a gray epoxy finish. Other acceptable manufacturers:
  - 1) Cheney Flashing Co.  
P. O. Box 818  
Trenton, N.J. 08605  
Phone: (800) 322-2873
  - 2) Petersen Aluminum  
955 Estes Avenue  
Elk Grove Village, IL 60007  
Phone: (800) 323-1960

## 2.3 COMPONENTS

- A. Gutters: Rectangular SMACNA style profile.
- B. Downspouts: Rectangular profile.
- C. Accessories: Profiled to suit gutters and downspouts.
- D. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3500 psi at 28 days, with minimum 5 percent air entrainment.
- E. Downspout Boots: Steel.

## 2.4 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, minimum 0.50 inches thick and continuous in width, interlockable with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Form material with standing seams.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches over roofing material. Return and brake edges.
- I. Fabricate snow guards in accordance with SMACNA Figure 8-12, Latest Edition.

## 2.5 FINISH

- A. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.



## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### 3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

### 3.3 INSTALLATION

- A. Conform to drawing details.
- B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners.
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Secure gutters and downspouts in place using concealed fasteners.
- H. Slope gutters 1/4 inch per foot minimum.
- I. Connect downspouts to downspout boots storm sewer system. Grout and connection watertight.
- J. Set splash pads under downspouts.
- K. Seal metal joints watertight.
- L. Use 50/50 solder and neutralize flux after soldering lead.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

## SECTION 07710

### MANUFACTURED ROOF SPECIALTIES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Copings, Facias and Gravel stops Vents.
- B. Prefabricated curbs and equipment support units.

##### 1.2 RELATED SECTIONS

- A. Section 05311 - Steel Roof Deck: Metal deck perimeter stops.
- B. Section 07416 - Seam Metal Roof System: Typical roof system.
- C. Section 07620 - Sheet Metal Flashing and Trim Metal flashings.

##### 1.3 REFERENCES

- A. ASTM D2822 - Asphalt Roof Cement.
- B. NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.
- C. SMACNA - Architectural Sheet Metal Manual.

##### 1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work reviewed and approved by manufacturer prior to submission.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Samples: Submit two samples, 6 x 8 inch in size illustrating component shape, finish, and color.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA details.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Architectural Products Co.
- B. W. P. Hickman Company
- C. Petersen Aluminum Corp.
- D. Custom Curb, Inc., Phone (800) 251-3001.
- E. Roof Products & Systems Corp., Phone (708) 595-7320.
- F. ThyCurb by the Thybar Corp, Phone (800) 777-2872.

### 2.2 COMPONENTS

- A. Copings and Gravel Stops: Formed aluminum, .063 inch thick, shaped as indicated, including special supports spaced as required. Include cover plates to conceal and weather seal joints and attachment flanges.
- B. Prefabricated Roof Curbs:
  - 1. Curbs shall be constructed using minimum 18 gauge galvanized steel, (14 gauge for curbs supporting HVAC units, or as deemed necessary by curb manufacturer), with fully mitered and welded corners, 3" integral cant, integral base plates, internally reinforced with 1" x 1" x 1/8" steel angle, factory insulated with 1-1/2" thick three pound density fiberglass insulation and factory installed pressure treated wood nailer.
    - a. Model CRC-1: Custom Curbs, Inc.
    - b. Model RC-4A Style: RPS, Corp.
    - c. Model TC-1: ThyCurb.

### 2.3 ACCESSORIES

- A. Sealant: Same as specified in Section 07900 - Single-Part Neutral Curing Silicone Sealant, Type S.
- B. Roofing Cement: ASTM D2822, Type I, cutback asphalt type.

## 2.4 FINISHES

- A. All metal shall be pre-finished aluminum coated with full strength Kynar 500 finish with a 20-year warranty by the manufacturer of the item.
- B. The coating shall conform to the following:
  - 1. Abrasion Resistance - ASTM D 968, the coefficient of sand abrasion will be 65 5 10.
  - 2. Accelerated Weathering - ASTM G-23, Type EH, Duration 5,000 hours.
  - 3. Adhesion - ASTM D3359, cross cut tape test per NCCA procedure No. II-5.
  - 4. Chalk Resistance - ASTM D 659, should have a no-chalk rating of 8 to 10.
  - 5. Chemical/Acid Pollution Resistance - ASTM D 1808, chemical spot test.
  - 6. Color Change - ASTM 2244, no greater than 5.0. E. Hunter units after removal of external deposits.
  - 7. Color Consistency - ASTM 2905, will not change color more than 5 NBS units.
  - 8. Formability - ASTM D 3281 and ASTM D 1737, can be formed without film fracture using normal metal shop practices to a 1 to 2-T bend radius.
  - 9. Gloss - ASTM D 523, Specular gloss of 30 degrees  $\pm$  5 degrees reflectivity at 60 degree angle.
  - 10. Hardness - ASTM D 3363, the pencil hardness will be F minimum.
  - 11. Humidity Resistance - ASTM 2247, Duration: 1,000 hours - no change in pencil hardness and no field blisters.
  - 12. Impact Resistance - ASTM D 2794, no removal when taped, National Coil Coated Association Technical Bulletin No. II-6, Impact force 70 in/lbs.
  - 13. Life Expectancy - 20 years plus; Architectural Tests: Weatherometer Method 6152 after 5,000 hours exposure value, acceptable per Fed Test Method 141.
  - 14. Salt Spray Resistance - ASTM B 117, Duration: 1,000 hours for hot dipped galvanized; 2,000 hours for Aluminum.
  - 15. Solvent Resistance - No comparable ASTM, solvent resistance per NCCA No. II-18 procedure.
  - 16. Weathering Dew Cycle - ASTM D 3361, unshielded dew cycle tested for 500 cycles Immersion in aerated distilled water at 80 degrees  $\pm$  10 degrees 500 hours plus 1 hour recovery.
- C. Color selection shall be from manufacturer's standard colors.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

### 3.2 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Conform to SMACNA - Architectural Sheet Metal Manual drawing details as noted.
- C. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- D. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- E. Coordinate installation of flashing flanges into reglets.

END OF SECTION

## SECTION 07900

### JOINT SEALERS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

##### 1.2 RELATED SECTIONS

- A. Section 04311 - Concrete Masonry Units: Sealant required in conjunction with control joints in concrete masonry unit walls.
- B. Section 04320 - Veneer Masonry System: Sealants required in conjunction with brick masonry.
- C. Section 07160 - Bituminous Dampproofing: Sealants required in conjunction with dampproofing.
- D. Section 07416 - Seam Metal Roof System: Sealants required in conjunction with metal roofing.
- E. Section 07620 - Sheet Metal Flashing and Trim: Sealants required in conjunction with metal flashings.
- F. Section 08520 - Aluminum Windows: Sealants required in conjunction with aluminum windows.
- G. Section 08800 - Glazing: Sealants required in conjunction with glazing methods.

##### 1.3 REFERENCES

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C919 - Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Elastomeric Joint Sealants.

- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- B. Samples: Submit two samples, 2 x 2 inch in size illustrating sealant colors for selection.
- C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform acoustical sealant application work in accordance with ASTM C919.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum five years documented experience approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 WARRANTY

- A. Provide a five year warranty.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.



## PART 2 PRODUCTS

### 2.1 SEALANTS

- A. Acrylic Emulsion Latex for interior use only (Type C): ASTM C834, single component; white color; manufactured by one of the following: Pecora Corp - "AC-20"; Sonolac" - Sonneborn Building Prod. Div., Chem Rex, Inc., "Temco Acrylic Latex 834" - Tremco.
- B. Polyurethane Sealant primary use for masonry joints (Type S): ASTM C920, Grade NS, Class 25, Use M,G,A; single component, chemical curing, non-staining, non-bleeding, non-sagging type; manufactured by one of the following: Mameco, Pecora Corp., Peterson, Harry S. PRC, Sika Corp., Tremco, color as selected.
  - 1. Elongation Capability 25 percent
  - 2. Service Temperature Range -40 to 180 degrees F
  - 3. Shore A Hardness Range 20 to 35
- C. Silicone Sealant primary use for glazing, metals, ceramic tiles (Type S): ASTM C920, Grade NS, Class 25, Use NT,M,G,A single component, chemical curing, non-sagging, non-staining, non-bleeding; manufactured by one of the following: Dow Corning; GE, Mobay Corp., Pecora Corp. color as selected.
  - 1. Elongation Capability 50 percent
  - 2. Service Temperature Range -35 to 160 degrees F
  - 3. Shore A Hardness Range 30

### 2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.

- B. Verify that joint backing and release tapes are compatible with sealant.

### 3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

### 3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.
- B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

### 3.4 CLEANING

- A. Clean adjacent soiled surfaces.

### 3.5 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

END OF SECTION

## SECTION 08111

### STANDARD STEEL DOORS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Non-rated and fire rated steel doors.
- B. Louvers.
- C. Metal transom panels to match the metal door construction.

##### 1.2 RELATED SECTIONS

- A. Section 04340 - Reinforced Unit Masonry System: Masonry mortar fill of metal frames.
- B. Section 08112 - Standard Steel Frames.
- C. Section 08211 - Flush Wood Doors.
- D. Section 08712 - Door Hardware.
- E. Section 08800 - Glazing: Glass for doors.
- F. Section 10200 - Louvers: Louvers for doors.
- G. Section 09900 - Painting: Field painting of doors.

##### 1.3 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 - Standard Steel Doors and Frames.
- C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM E152 - Methods of Fire Tests of Door Assemblies.

- E. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- F. NFPA 80 - Fire Doors and Windows.
- G. NFPA 252 - Fire Tests for Door Assemblies.
- H. UL 10B - Fire Tests of Door Assemblies.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finish.
- B. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.
- C. Manufacturer's Installation Instructions: Indicate special installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Fire Rated Door Construction: Conform to ASTM E152.
- B. Fire Rated Door Construction: Rate of rise of 250 F degrees across door thickness.
- C. Installed Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Doors shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.
- B. Protect doors with resilient packaging sealed with heat shrunk plastic.
- C. Break seal on-site to permit ventilation.

## 1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## PART 2 PRODUCTS

### 2.1 DOOR MANUFACTURERS

- A. Fenestra Corporation
- B. Republic Builders Products
- C. Steelcraft Manufacturing Company

### 2.2 DOORS

Grade II - Heavy-duty 1-3/4 inches (44 mm) (Level B): Interior Doors

Model 3 - Seamless - Hollow Steel Construction

OR

Model 4 - Seamless - Composite Construction

Grade III - Extra heavy-duty 1-3/4 inches (44 mm) (Level A): Exterior Doors

Model 4 - Seamless - Composite Construction

OR

Model 5 - Flush Panel - Stile and Rail Construction

- A. Exterior Doors (Thermally Broken): SDI-100 Grade III Model 4. Minimum gauge for face metal sheet shall be 14 gauge.
- B. Interior Doors (Non-rated): SDI-100 Grade II Model 3 or 4. Face metal for interior doors shall be 18 gauge.

- C. Interior Doors (Fire Rated): SDI-100 Grade II Model 3 or 4. Face metal for interior fire-rated doors shall be 18 gauge.

## 2.3 DOOR CONSTRUCTION

- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: Cardboard honeycomb steel channel grid vertical steel stiffeners.

## 2.4 ACCESSORIES

- A. Louvers:
  - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected. Wipe coat of zinc.
  - 2. Louver Blade: Inverted V blade, sight proof.
  - 3. Louver Free Area: 50 percent.
  - 4. Frame: flush style with surface tamper proof fasteners.
- B. Removable Stops: Rolled steel shape, butted corners; prepared for countersink style tamper proof screws.
- C. Primer: Zinc chromate type.

## 2.5 FABRICATION

- A. Astragals for Double Doors: Steel, Z shaped, specifically for double doors.
- B. Fabricate doors with hardware reinforcement welded in place.
- C. Attach fire rated label to each door unit.
- D. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal joints watertight.
- E. Configure exterior doors with special profile to receive recessed weatherstripping.

## 2.6 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 G60.

- B. Primer: Air dried.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.

### 3.2 INSTALLATION

- A. Install doors in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate installation of glass and glazing.
- C. Install door louvers, plumb and level.
- D. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 08710.

### 3.3 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### 3.4 ADJUSTING

- A. Adjust door for smooth and balanced door movement.

END OF SECTION

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## SECTION 08112

### STANDARD STEEL FRAMES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Non-rated, fire rated steel frames.
- B. Interior glazed light frames.

##### 1.2 RELATED SECTIONS

- A. Section 04340 - Reinforced Unit Masonry System: Masonry mortar fill of metal frames.
- B. Section 08111 - Standard Steel Doors.
- C. Section 08211 - Wood Doors.
- D. Section 08712 - Door Hardware.
- E. Section 08800 - Glazing.
- F. Section 09900 - Painting: Field painting of frames.

##### 1.3 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 - Standard Steel Doors and Frames.
- C. ASTM A525 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM E152 - Methods of Fire Tests of Door Assemblies.
- E. DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- F. NFPA 80 - Fire Doors and Windows.
- G. NFPA 252 - Fire Tests for Door Assemblies.
- H. UL 10B - Fire Tests of Door Assemblies.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate frame elevations, reinforcement, and finish.
- B. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement.
- C. Samples: Submit two carrier samples of frame, 12 x 12 inch in size illustrating construction of frame and surface texture.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

1.7 REGULATORY REQUIREMENTS

- A. Fire Rated Frame Construction: Conform to ASTM E152.
- B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. To provide protection during shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or provided with temporary steel spreaders at the bottom of each frame. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting good air circulation. Assembled frames shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.
- B. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## PART 2 PRODUCTS

### 2.1 FRAME MANUFACTURERS

- A. Fenestra Corporation
- B. Republic Builders Products
- C. Steelcraft Manufacturing Company

### 2.2 FRAMES

- A. Exterior Frames: 14 gage thick material, base metal thickness unless otherwise indicated on Drawings.
- B. Interior Frames: 16 gage thick material, base metal thickness.

### 2.3 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole.
- B. Removable Stops: Rolled steel channel shape, butted corners; prepared for countersink style tamper proof screws.
- C. Bituminous Coating: Fibered asphalt emulsion.
- D. Primer: Zinc chromate type.

### 2.4 FABRICATION

- A. Fabricate frames as welded unit.
- B. Mullions for Double Doors: Fixed type, of same profiles as jambs.
- C. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- D. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- E. Prepare frame for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.

- F. Configure exterior frames with special profile to receive recessed weatherstripping.
- G. Fabricate frames to suit masonry wall coursing with 4 inch head member.

## 2.5 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 G60.
- B. Primer: Air dried.
- C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.

### 3.2 INSTALLATION

- A. Install frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate with masonry and wallboard wall construction for anchor placement.
- C. Coordinate installation of glass and glazing.
- D. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08111.
- E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

### 3.3 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

END OF SECTION

SECTION 08211  
FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid flush wood doors; flush and flush glazed configuration.

1.2 RELATED SECTIONS

- A. Section 08112 - Standard Steel Frames: Steel door frames.
- B. Section 08712 - Door Hardware.
- C. Section 08800 - Glazing.
- D. Section 09900 - Painting: Site finishing doors.
- E. Section 10255 - Door Louvers: Metal louvers.

1.3 REFERENCES

- A. ANSI A135.4 - Basic Hardboard.
- B. ASTM E90 - Measurement of Airborne Sound Transmission Loss of Building Partitions.
- C. ASTM E413 - Classification for Determination of Sound Transmission Class.
- D. AWI - Quality Standards of the Architectural Woodwork Institute.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, special blocking for hardware, identify cutouts for glazing and louvers.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria.
- C. Samples:
  - 1. Submit two samples of door construction, 12 x 12 inch (304.8 x 304.8 mm) in size cut from top corner of door.

- D. Manufacturer's Installation Instructions: Indicate special installation instructions.

## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Quality Standard Division 1, Premium Grade.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of General Requirements.
- B. Package, deliver and store doors in accordance with AWI Division 1.

## 1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.9 COORDINATION

- A. Coordinate work under provisions of General Requirements.
- B. Coordinate the work with door opening construction, door frame and door hardware installation.

## 1.10 WARRANTY

- A. Provide manufacturer s warranty including replacement, refinishing and rehanging:
  - 1. Life of Original Installation : Interior doors.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Algoma/Hardwoods, Algoma, WI, Ph 800-678-8910: Product - Architectural Wood Flush Door

- B. Eggers Industries, Two Rivers, WI ph 414-793-1351: Product Architectural Wood Flush Door
- C. Weyerhaeuser Architectural Door Div., Marshfield, WI ph 800-869-3667: Product - Architectural Wood Flush Door

## 2.2 DOOR TYPES

- A. Flush Interior Doors: 1-3/4 inches thick; solid core construction.

## 2.3 DOOR CONSTRUCTION

- A. Core Solid, Non-Rated: AWI Division 1, Type PC5-Particleboard.
- B. Core Solid, Fire Rated: AWI Division 1, Type FD 1-1/2, FD1 and FD 1/3.

## 2.4 FLUSH DOOR FACING

- A. Veneer Facing (Flush Interior Doors): AWI Custom quality species wood, rotary cut, birth with MDO (medium density overlay) for paint finish.

## 2.5 ADHESIVE

- A. Facing Adhesive: Type II - water resistant.

## 2.6 ACCESSORIES

- A. Metal Louvers: Specified in Section 10255.
- B. Glazing Stops: Wood, of same species as door facing shape, mitered corners; prepared for countersink style tamper proof screws.

## 2.7 FABRICATION

- A. Fabricate non-rated and fire rated 5 ply doors in accordance with AWI quality standards requirements and U.L. requirements.
- B. Sound Rating For Single Door Leaf and Frame Assembly: ASTM E413, minimum STC 35.
- C. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.

- D. Vertical Exposed Edge of Stiles: Of same species as veneer facing for paint finish.
- E. Fit door edge trim to edge of stiles after applying veneer facing.
- F. Bond edge banding to cores.
- G. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.
- H. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.
- B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.2 INSTALLATION

- A. Install non-rated doors in accordance with AWI Quality Standards requirements.
- B. Trim non-rated door width by cutting equally on both jamb edges.
- C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).
- D. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.
- E. Machine cut for hardware. Core for handsets and cylinders.
- F. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 08710.
- G. Coordinate installation of glass and glazing.
- H. Install door louvers, plumb and level.

### 3.3 INSTALLATION TOLERANCES

- A. Conform to AWI requirements for fit and clearance tolerances.



- B. Conform to AWI Division 1 requirements for maximum, vertical, width, and diagonal distortion.

### 3.4 ADJUSTING

- A. Adjust door for smooth and balanced door movement.

END OF SECTION



## SECTION 08331

### OVERHEAD COILING DOORS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Overhead coiling door, operating hardware, electric operation.
- B. Wiring from electric circuit disconnect to door operator to control station.

##### 1.2 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Support framing.
- B. Section 08710 - Door Hardware: Cylinder core and keys.
- C. Section 09900 - Painting: Field paint finish.
- D. Section 16111 - Conduit: Conduit from electric circuit to door operator and from door operator to control station.
- E. Section 16111 - Conduit: Conduit from fire alarm control to fusible link activator.
- F. Section 16180 - Equipment Wiring Systems: Power to disconnect.

##### 1.3 REFERENCES

- A. ASTM A480/A480M - Flat Rolled Stainless Heat Resisting Steel Plate, Sheet, and Strip.
- B. ASTM A525/A525M - Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process.
- C. ASTM A526/A526M - Steel Sheet, Zinc-coated (Galvanized) by the Hot-dip Process, Commercial Quality.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- F. NEMA MG1 - Motors and Generators.
- G. UL - Fire Resistance Directory.

#### 1.4 SYSTEM DESCRIPTION

- A. Electric motor operated unit with manual override in case of power failure.
- B. Coiling Door: Surface mounted.

#### 1.5 DESIGN REQUIREMENTS

- A. Design door assembly to withstand wind/suction load of 30 psf, without undue deflection or damage to door or assembly components.
- B. Insulation Value: R of 6.25.

#### 1.6 SUBMITTALS: Division 1 - Procedures for submittals.

- A. Product Data: Provide general construction, component connections, details, and electrical equipment.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- C. Samples: Submit two door slats, 6 x 12 inch in size illustrating shape, color and finish texture.
- D. Manufacturer's Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

#### 1.7 DATA PROVIDED AT CLOSEOUT

- A. Operation and Maintenance Data; Warranties and Bonds.
- B. Maintenance Data: Indicate lubrication requirements and frequency, periodic adjustments required.

#### 1.8 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Manufacturers:

1. Atlas Roll-Lite Overhead Doors, Div. of MASCO.
2. The Cookson Company
3. Overhead Door Corp.

### 2.2 MATERIALS

#### A. Curtain: conforming to the following:

1. Slats:
  - a. Insulated slats shall be furnished for all exterior overhead coiling doors. Slats shall be interlocking, minimum 24 gage (.607 mm thick) of ASTM A526 steel, galvanized to minimum 1.25 oz/sq ft (380 g/sq m) coating in accordance with ASTM A525; sandwich slat construction with insulated core of polyurethane type insulation.
  - b. Non-insulated slats shall be furnished for all interior overhead coiling doors. Slats shall be interlocking, minimum 22 gauge (0.759 mm thick) of ASTM A526 steel, galvanized to minimum 1.25 oz/sq. ft. (380 g/sq m) coating in accordance with ASTM A525; single thickness slat.
2. Nominal Slat Size: 3 inches (75 mm) wide x required length.
3. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
4. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact with floor in closed position.
5. Vision Lites: Furnish clear acrylic plastic sections over individual slats cutouts, each 5" wide x 3/4" high, in sets of 3 cutouts, one slat high, three cutouts wide. Vision lite slat to be standard F-3 non-insulated flat slat.

- B. Guides: 3/16 in. gage thick); 3 inch wide; galvanized steel conforming to ASTM A526, galvanized to minimum 1.25 oz/sq ft (380 g/sq m) coating in accordance with ASTM A525 of continuous angles, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

- C. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and

capable of holding position at mid-travel; with adjustable spring tension.

- D. Hood Enclosure: 24 gage galvanized steel; internally reinforced to maintain rigidity and shape.

## 2.3 ELECTRIC OPERATOR

- A. Electric Operator:
  - 1. Description: UL 325, side mounted.
  - 2. Motor Enclosure: NEMA MG1 Type 1; open drip proof.
  - 3. Motor Rating: 3/4 hp (560 W); continuous duty.
  - 4. Motor Voltage: 208-230 volt, three phase, 60 Hz.
  - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
  - 6. Controller Enclosure: NEMA 250 Type 1.
  - 7. Door Speed: 12 inches per second (300 mm/s)
  - 8. Brake: Adjustable friction clutch type, activated by motor controller.
- B. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator; 24 volt circuit; surface mounted.
- C. Safety Edge: Located at door bottom, full width, electro-mechanical sensitized type, wired to stop, reverse door upon striking object, hollow neoprene covered weather seal.

## 2.4 FINISHES

- A. Curtain Slats: Steel, galvanized.
- B. Steel Guides and Hood Enclosure: Prime paint.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify that opening sizes, tolerances and conditions are acceptable.

### 3.2 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 16180. Complete wiring from disconnect to unit components and from fire alarm system to door operator.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
- G. Install perimeter trim and closures.

### 3.3 ERECTION TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).
- C. Maximum Variation From Level: 1/16 inch (1.5 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

### 3.4 ADJUSTING

- A. Adjust door, hardware and operating assemblies for smooth and noiseless operation.

### 3.5 CLEANING

- A. Clean door and components.
- B. Remove labels and visible markings.

END OF SECTION





## SECTION 08410

### ALUMINUM ENTRANCES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Aluminum doors and frames.
- B. Vision glass infill panels.
- C. Door hardware.
- D. Perimeter sealant.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 05500 - Metal Fabrication: Placement of structural supporting anchors.

##### 1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 08712 - Door Hardware: Hardware items other than specified in this section.

##### 1.4 RELATED SECTIONS

- A. Section 09260 - Gypsum Board System: Preparation of adjacent work to receive work of this section.
- B. Section 05500 - Metal Fabrications: Metal fabricated attachment devices and framed openings.
- C. Section 07900 - Sealants: System perimeter sealant and back-up materials.
- D. Section 08520 - Aluminum Windows: Operable sash within glazing system.
- E. Section 08800 - Glazing.

##### 1.5 REFERENCES

- A. AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

- B. AAMA - Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.
- C. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- D. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- E. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
- F. ANSI A117.1 - Safety Standards for the Handicapped.
- G. ANSI/ASTM A36 - Structural Steel.
- H. ANSI/ASTM A386 - Zinc Coating (Hot Dip) on Assembled Steel Products.
- I. ANSI/ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ANSI/ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- K. ANSI/ASTM E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- L. ANSI/ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- M. ANSI/ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- N. SSPC - Steel Structures Painting Council.

#### 1.6 SYSTEM DESCRIPTION

- A. Aluminum entrances and tubular aluminum sections, shop fabricated, factory pre-finished, vision glass, infill, related flashings, anchorage and attachment devices.

#### 1.7 PERFORMANCE REQUIREMENTS

- A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with local code to a design pressure of 30 lb/sq ft (1.43 KPa) and as measured in accordance with ANSI/ASTM E330.

- B. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- C. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees over a 12 hour period without causing detrimental affect to system components.

1.8 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.
- B. Product Data: Provide component dimensions, describe components within assembly, glass and infill, door hardware, and manufacturer's standard color chart for the High Performance Organic coating.
- C. Samples: Submit two samples 4 x 4 inches in size illustrating pre-finished aluminum surface and glazing materials.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.9 QUALITY ASSURANCE

- A. Perform Work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Conform to requirements of ANSI A117.1.

1.10 QUALIFICATIONS

- A. Manufacturer and Installer: Company specializing in manufacturing aluminum doors with minimum six years documented experience.

1.11 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this Section.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum entrance doors components in the manufacturer's original protective packaging.

- B. Store aluminum entrance doors in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.
- C. Protect pre-finished aluminum surfaces with wrapping stripable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

#### 1.13 ENVIRONMENTAL REQUIREMENTS

- A. Do not install sealants when ambient temperature is less than 40 degrees during and 48 hours after installation.

#### 1.14 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

#### 1.15 WARRANTY

- A. Provide three year warranty.
- B. Warranty: Include coverage for complete system for failure to meet specified requirements.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable manufacturers offering equivalent Products.
  - 1. Kawneer Company, Inc.
  - 2. United States Aluminum Corp.
  - 3. Vistawall Architectural Products

#### 2.2 MATERIALS

- A. Extruded Aluminum: ANSI/ASTM B221; 6063 alloy, T5 temper.
- B. Fasteners: Stainless steel.
- C. Shop and Touch-Up Primer for Steel Components: SSPC 15, Type 1, red oxide.

#### 2.3 COMPONENTS

- A. Doors: 1-3/4 inches thick, 3-1/2 inch wide top rail, 3-1/2 inch wide vertical stiles, 6-1/2 inch wide bottom rail; square glazing stops.

## 2.4 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials: As specified in Section 08800 of Types described below:
  - 1. Glass in Door Lights: Type FG-B.

## 2.5 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 07900 of Types described below.
  - 1. Perimeter Sealant: Type (S) Silicone.
  - 2. Sealant Used Within System (Not Used for Glazing): Type (S) Silicone.

## 2.6 HARDWARE

- A. Weather Stripping: Wool pile, continuous and replaceable.
- B. Sill Sweep Strips: Retracting resilient seal type, of neoprene compound.
- C. Threshold: Extruded aluminum, one piece per door opening, ribbed non-slip surface.
- D. Hinges: Swing clear butt type.
- E. Push/Pull: staple 1" O.D. dia. style.
- F. Panic Device: Concealed in the door type.
- G. Closer: Concealed overhead.
- H. Cylinder Lock: Cylinders on exterior side of doors.

## 2.7 FABRICATION

- A. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

## 2.8 FINISHES

- A. Exterior and interior exposed aluminum of the doors shall have the same finish coatings conforming to AAMA 605.2.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.

- B. Verify frame openings are ready to receive work of this Section.

### 3.2 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Set thresholds in bed of mastic and secure.
- E. Install hardware using templates provided.
- F. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.

### 3.3 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

### 3.4 ADJUSTING

- A. Adjust operating hardware for smooth operation.

### 3.5 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

### 3.6 PROTECTION OF FINISHED WORK

- A. Protect finished Work from damage.

END OF SECTION

## SECTION 08450

### ALL-GLASS DOORS (TROPHY CASE)

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. All-glass doors and required fittings hardware.

##### 1.2 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications: Miscellaneous steel supports.
- B. Section 08710 - Door Hardware: Cylinder for locks.
- C. Section 08800 - Glazing: Glass shelves.
- D. Section 09260 - Gypsum Board System.

##### 1.3 REFERENCES

###### AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

AAMA 605.2 (1985) Voluntary Specifications for High-Performance Organic Coating on Architectural Extrusions and Panels

###### AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI A156.5 (1984) American National Standard for Auxiliary Locks & Associated Products

ANSI Z97.1 (1984) Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

###### AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM B221 (1993) Specifications for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM C1048 (1992) Specifications for Heat Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated

###### CONSUMER PRODUCT SAFETY COMMISSION

CPSC 16 CFR PART 1201: Safety Standard for Architectural Glazing Materials

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

1988 Edition: Metal Finishes Manual for Architectural and Metal Products

### 1.4 SYSTEM DESCRIPTION

- A. All-glass doors with required fittings and hardware.

### 1.5 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Data for all-glass door; including manufacturer's standard details and fabrication methods. Data on finishing, hardware, and accessories. Recommendations for maintenance and cleaning of exterior surfaces.
- C. Shop Drawings: Provide installation drawings for the all-glass doors including:
  - Elevation at 1/4 inch scale.
  - Detail sections of fittings.
  - Hardware mounting heights.
  - Anchorage and reinforcement.
- D. Samples: For initial color selection, submit pairs of samples of each specified metal color and finish on 12-inch long section of extrusions or formed shapes.
  - 1. Samples for Verification Purposes: Submit samples of glass required approximately 6-inches square showing the edge condition.

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed installations of all-glass doors similar in design and extent to those required for the Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer's Qualifications: Provide all-glass doors produced by a firm experienced in manufacturing entrance systems that are similar to those indicated for this project and that have a record of successful in-service performance.
- C. Single Source Responsibility: Obtain all-glass doors from one source from a single manufacturer.
- D. Design Criteria: The drawings indicate the size, profile, and dimensional requirements of the all-glass doors required and are based on the specific types and models indicated. All-glass entrances by other manufacturers may be considered provided deviations in



dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

- E. Safety Glass Standard: Provide tempered-glass components that comply with ANSI Z97.1 and testing requirements of CPSC 16 CRF Part 1201 II.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver all-glass doors and related components in the manufacturer's original protective packaging. Do not deliver door units until the work is ready for their installation.
- B. Inspect components for damage upon delivery. Unless minor defects in metal components can be repaired to the Contract Officer's satisfaction, remove and replace damaged components.

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.
- B. Where necessary, proceed with fabrication without measurements, and coordinate fabrication tolerances to ensure proper fit.

#### 1.9 WARRANTY

- A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace all-glass door units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:
  - Structural failures.
  - Faulty operation.
  - Deterioration of metals, metal finishes, and other materials.
- B. Warranty Period: 3 years after the date of Substantial Completion.
  - 1. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturers

1. ACI Glass Products  
12900 Nicholson Road  
Farmers Branch, TX 75234  
(800) 284-4527
2. Blumcraft of Pittsburg  
460 Melwood Street  
Pittsburg, PA 15213  
(412) 681-2400
3. Bright Vue Glass System Inc.  
Kawneer Company, Inc.  
Jonesboro, Georgia (404) 478-8841  
Kent, Washington  
(206) 872-2555

### 2.2 MATERIALS

- A. Glass: Provide flat, fully tempered glass in thickness indicated for doors, sidelights, and transoms. Comply with requirements of ASTM C 1048 for kind FT (fully tempered), Condition A (uncoated surfaces), type I (transparent), Class 1 (clear) glass.
1. Thickness: ½ inch.
  2. Edge Treatment: Provide machine ground and polished edges for exposed glass edges of doors, sidelights, and transoms and flat ground edges for butting glass edges.
- B. Door Fittings: Provide manufacturer's standard fittings of the profile and arrangement indicated. Comply with requirements indicated for kind and form of metal and finish.
1. Aluminum: provide fittings fabricated from aluminum extrusions of alloy and temper recommended by manufacturer for use intended and required for application of finish indicated, but not less than strength and durability properties specified in ASTM B 221 for 6063-T5.
- C. Accessory Fittings: Provide manufacturer's standard accessory fittings of the type indicated. Comply with requirements indicated for kind and form of metal and finish of door fittings.

- D. Anchors and Fastenings: Manufacturer's standard concealed anchors and fastenings. Do not use exposed fasteners.

## 2.3 HARDWARE

- A. General: Provide hardware units as indicated for operation of door, including the following items of sizes, number and type recommended by the manufacturer for the type of service required. Provide metal and finish for exposed parts to match finish of exposed fittings.
  - 1. Off-set top and bottom pivots as indicated on the drawings at manufacturer's recommendations for size, depending on door size, and anticipated frequency of use. Include the following:
    - a. Non-hold-open.
  - 2. Locks: Equip doors with manufacturer's locksets that accept a standard cylinder with related components. Comply with the following:
    - a. Location and Function: Provide deadbolt in continuous bottom fitting. Lock shall be operated by key outside with deadbolt engaging cutout in threshold.
  - 3. Cylinders are supplied under another Division 8 Section, for keying into building system.
  - 4. Threshold: Provide manufacturer's standard extruded aluminum threshold in mill finish. Coordinate cutouts with operating hardware. Include anchors and jamb clips.

## 2.4 FABRICATION

- A. General: Fabricate all-glass doors components to designs and sizes indicated. Sizes of doors and profile requirements of fittings and hardware are indicated on the drawings.
  - 1. Locate and provide holes and cutouts in glass to receive hardware before tempering glass. Do not permit cutting, drilling or other alterations to glass after tempering.
  - 2. Fabricate work to accommodate required fittings, hardware, anchors, reinforcement, and accessory items.
- B. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.

- C. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.

- 1. Uniformity of Metal Finish: Abutting fittings shall not have an integral color variation greater than half the range indicated in the sample submittal, as judged solely by the Contract Officer.

## 2.5 METAL FINISHES

- A. General: Comply with AAMA specification 605.2-85 for a two (2) coat high-performance organic coating on the exposed surfaces of the aluminum fittings. Color to match the curtain wall extrusions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and supports, with the Installer, present for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of all-glass doors. Correct unsatisfactory conditions before proceeding with the installation.
  - 1. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. Install all-glass entrance doors and associated components in accordance with manufacturer's printed instructions and recommendations.
  - 1. Set units level, plumb, and true to line.
  - 2. Lubricate hardware and other moving parts.

### 3.3 ADJUSTING

- A. Adjust doors and hardware to provide a tight fit at contact points and at weatherstripping and for smooth operation and weathertight closure.
- B. Hardware: Adjust operating hardware to ensure proper operation. Set, seal, and grout floor closer cases. Coordinate cylinder installation.

### 3.4 CLEANING

- A. Clean door and frame surfaces promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation, complying with requirements contained in the Glass and Glazing Section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt, and other substances.

### 3.5 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that all-glass entrances will be without damage or deterioration, other than normal weathering at the time of acceptance.

END OF SECTION



## SECTION 08710

### DOOR HARDWARE

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Hardware for wood, hollow steel aluminum doors.
- B. Thresholds.
- C. Weatherstripping, seals and door gaskets.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 08111 - Standard Steel Frames: Furnish templates for frame preparation.
- B. Section 08112 - Standard Steel Doors: Furnish templates for door preparation.
- C. Section 08410 - Aluminum Entrances and Storefronts: Furnish lock cylinders for installation.

##### 1.3 RELATED SECTIONS

- A. Section 08111 - Standard Steel Doors.
- B. Section 08112 - Standard Steel Frames.
- C. Section 08331 - Overhead Coiling Doors: Lockable coiling doors.
- D. Section 08410 - Aluminum Entrances and Storefronts: Hardware for same except cylinders.

##### 1.4 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ADA: Accessibility Guidelines.
- C. Local, State and Federal requirements.
- D. NFPA 80 - Fire Doors and Windows.
- E. AWI - Architectural Woodwork Institute - Quality Standards.

F. NFPA 252 - Fire Tests of Door Assemblies.

G. UL 10B - Fire Tests of Door Assemblies.

H. UL 305 - Panic Hardware.

1.5 SUBMITTALS: Submit under provisions of Division 1.

A. Shop Drawings: Indicate locations and mounting heights of each type of hardware.

B. Manufacturer's Data: Submit manufacturer's parts lists, templates, and maintenance instruction.

C. Samples: Submit color and finish samples.

1.6 PROJECT RECORD DOCUMENTS

A. Record actual locations of installed cylinders and their master key code.

1.7 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 QUALITY ASSURANCE

A. Perform work in accordance with the following requirements:

1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. NFPA 101.
3. NFPA 80.
4. NFPA 252.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with 10 years documented experience. approved by manufacturer.



- C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

#### 1.10 REGULATORY REQUIREMENTS

- A. Conform to applicable local code for requirements applicable to fire rated doors and frames.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- C. Deliver keys to Government by security shipment direct from hardware supplier.

#### 1.12 COORDINATION

- A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

#### 1.13 WARRANTY

- A. Provide five year warranty under General Provisions.

#### 1.14 MAINTENANCE MATERIALS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

### PART 2 PRODUCTS

#### 2.1 SUPPLIERS

- A. Corbin & Russwin Architectural Hardware.
- B. Yale Security Inc.

- C. Schlage Lock, Div. Ingersoll-Rand, Door Hardware Co.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Hinges: Bommer Industries, Hager Hinge Co. and McKinney Products Co.
- B. Latch Sets: Corbin, Yale, and Schlage.
- C. Push/Pulls: Builder Brass Works Corp, H. B. Ives and Trimco.
- D. Cylinder Locks: Best Lock Corp, Corbin, and Yale.
- E. Mortise Locks: Corbin, Yale, and Schlage.
- F. Exit Devices: Corbin, Sargent, and Von Durpin
- G. Closers: Dorma, LCN and Rixson.
- H. Gasketing: National Guard Prod., Pemko, and Zero International
- I. Protection Plates: Baldwin Hdw Corp., H.B. Ives, and Trimco.

## 2.3 KEYING

- A. Door Locks: Coordinate with customer (assistant Engineer) 206-281-3142 on Keying plan, Final key all locks to plan. Master keyed. Grand master keyed. Include construction keying, control keying with removable core cylinders.
- B. Supply keys in the following quantities:
  - 1. 10 master keys.
  - 2. 10 grand master keys.
  - 3. 10 great grand master keys.
  - 4. 10 construction keys.
  - 5. 10 control keys and 8 extra cylinder cores.
  - 6. 10 change keys for each lock bitting.
  - 7. 10 keys for each door

## 2.4 KEY CABINET

- A. Cabinet Construction: Sheet steel construction, piano hinged door with 5 pin tumbler type lock master keyed to building system.

- B. Cabinet Size: Size for project keys plus 10 percent growth.
- C. Horizontal metal strips for key hook labeling with clear plastic strip cover over labels.
- D. Finish: Baked enamel, finish, color as selected.

## 2.5 FINISHES

- A. Finishes: Identified in schedule at end of section.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.

### 3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions.
- B. Use templates provided by hardware item manufacturer.
- C. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
  - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
  - 2. NWWDA Industry Standard I.S.1.7, "Hardware Location for Wood Flush Doors."

### 3.3 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

### 3.4 ADJUSTING

- A. Adjust hardware for smooth operation.

### 3.5 PROTECTION OF FINISHED WORK

- A. Do not permit adjacent work to damage hardware or finish.

### 3.6 SCHEDULES

#### SET 1

##### Single Door Non Rated

Office doors with key lockset, closer, BB butts

Each to have:

- 1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
- 1 Lockset ML2267 NSR
- 1 Closer DC2200 - H.O.
- 1 Kick Plate
- 1 Mop Plate
- 1 Wallstop 409
- 3 Silencers 608

#### SET 2

##### Single Door Rated

Office Doors with key lockset, closer, BB butts

Each to have:

- 1-1/2 PR Butts BB1168 - Sec. Stud 4-1/2 x 4-1/2
- 1 Lockset ML 2267 NSR
- 1 Closer DC2200
- 1 Kick Plate
- 1 Mop Plate
- 1 Wallstop 409
- 3 Silencers 608

#### SET 3

##### Single Door Non Rated

Doors with special function lockset. Turn of master or lock up key in inside cylinder locks or unlocks outside knob/lever. BB butts, closer

Each to have:

- 1-1/2 PR Butts BB1168 SEC Stud 4-1/2 x 4-1/2
- 1 Lockset ML2242HS
- 1 Closer DC2200
- 1 Wallstop 409
- 3 Silencers 608
- 1 Kick Plate
- 1 Mop Plate

#### SET 4

##### Single Door Rated

Doors with special function lockset. Turn of master or lock up key in inside. Outside knob/lever.

BB butts, closer

Each to have:

1-1/2 PR Butts BB1168 SEC Stud 4-1/2 x 4-1/2

1 Lockset ML2242~~HS~~

1 Closer DC2200 SNB

1 Wallstop 409

3 Silencers 608

1 Kick Plate

1 Mop Plate

#### SET 5

##### Single Door Non Rated

Door with classroom lockset, closer, lock or unlock by key, inside knob/free

Each to have:

1-1/2 PR Busst BB1168 Sec. Stud 4-1/2 x 4-1/2

1 Lockset ML2255~~HS~~

1 Closer DC2200

OR

1 Closer DC2200 PA (Parallel Arm) (PA)

1 Wallstop 409

3 Silencers 608

1 Kick Plate

1 Mop Plate

#### SET 6

##### Single door Rated

Door with classroom lockset, closer, lock or unlock by key, inside knob/free.

Each to have:

1-1/2 PR Butts BB1168 Sec Stud 4-1/2 x 4-1/2

1 Lockset ML2255~~HS~~

1 Closer DC2200

OR

1 Closer DC2200 PA SNB

1 Wallstop 409

3 Silencers 608

1 Kick Plate

1 Mop Plate

## SET 7

### Single Door Non Rated

Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.

Each to have:

- 1-1/2 PR BB Butts 1168 Sec. Stud 4-1/2 x 4-1/2
- 1 Lockset ML2257HS
- 1 Wallstop 409
- 3 Silencers 608
- 1 Closer DC2200
- 1 Mop Plate

## SET 8

### Single Door Rated

Doors with lockset, BB hinges, closer, open with key only, inside knob/lever free.

Each to have:

- 1/2 PR BB Butts 168 Sec. Stud 4-1/2 x 4-1/2
- 1 Lockset ML2257HS
- 1 Wallstop 409
- 3 Silencers 608
- 1 Closer DC2200 SNB
- 1 Mop Plate

## SET 9

### Single Door Non Rated

Doors with push plate, pull plate, BB butts, closer, deadlock

Each to have:

- 1-1/2 PR Butts BB1168 4-1/2 x 4-1/2
- 1 Push Plate 6" x 18"
- 1 Pull Plate 4" x 16"
- 1 Closer DC2200
- 1 Wallstop 409
- 3 Silencers 608
- 1 Deadlock DL4017 Center Cyl 60" above bottom of frame
- 1 Kick Plate
- 1 Mop Plate

## SET 10

### Single Door Rated

Doors with BB butts, closer, deadlock

Each to have:

- 1-1/2 PR Butts BB1168 4-1/2 x 4-1/2

1 Closer DC2200 SNB  
1 Wallstop 409  
3 Silencers 608  
1 Lockset ML2265~~HS~~ NSR  
1 Kick Plate  
1 Mop Plate

SET 11

Single Exterior Non Rated

Single exterior doors with exit device, closer, weatherstrip - threshold

Each to have:

1-1/2 PR Butts BB1199 4-1/2 x 4-1/2 Sec. Stud  
1 Exit Device ED6200 Non Rated Door  
N455 Newport x Hi Security Cylinder  
1 Closer P-DC2200 A5 (PA) (Parallel Arm)  
Extra heavy closer with back stop arm (add each for hold open)  
1 Threshold (Handicap) Type 896X NGP Alum.  
1/4" high - XMSLA  
1 Set Weatherstrip Type PF182 NGP Char.

SET 12

Single Interior Rated

Single interior door to stairs

Each to have:

1-1/2 Pr Butts BB1199 4-1/2 x 4-1/2 - Sec. Stud  
1 Exit Device, E6200A  
N455 - Newport x Hi Security Cylinder  
1 Closer P-DC2200-A5 (PA) (Parallel Arm)

SET 13

Double Exterior Non Rated

Double exterior doors with exit device, closer, weatherstrip - threshold

Each leaf to have:

1-1/2 PR Butts BB1199 4-1/2 x 4-1/2 Sec Stud  
1 Exit Device ED6200  
N455 - Newport x Hi Security Cylinder  
1 Closer P-DC2200 - A5 (PA) (Parallel Arm)  
1 Threshold (Handicap) Type 896X NGP Alum.  
1/4" high - XMSLA  
1 Set Weatherstrip Type PF182 NGP Char.  
507 Removable Mullion

SET 14

Interior Double Door Non Rated

Pair of doors with lock, flush bolts, closer, act. door only.

Each to have:

3 PR Butts BB1168 4-1/2 x 4-1/2

1 Lockset ML2242HS

2 Flush Bolts 555

1 Closer P-DC2200 Parallel Arm-Active Door Only

1 Stop 409

2 Silencers 608

2 Kick Plates

2 Mop Plates

SET 15

Interior Double Door Rated

Pair of doors with lock, flush bolts, closer, Act. door only.

Each to have:

3 PR Butts BB1168 4-1/2 x 4-1/2

1 Lockset ML2242HS

2 Flush Bolts 555 Automatic

2 Closers DC2200

1 Stop 409

2 Silencers 608

2 Kick Plates

2 Mop Plates

SET 16

Corridor Double Doors Non Rated

Pair corridor doors, interior, locked with exit devices.

Each to have:

3 PR Butts BB1168 4-1/2 x 4-1/2

1 Exit Device (RHR Active Door) ED 6400 x Newport N455 Trim

1 Exit Device (LHR Inactive Door) ED6400

2 Door Closers DC2200

2 Wallstops 409

2 Silencers 608

2 Kick Plates

2 Mop Plates



## SET 17

### Corridor Double Door Rated

Pair-Label corridor doors, interior, locked with exit devices. Doors must fit within 5/16" of finish floor.

Each to have:

- 3 PR Butts BB1168 4-1/2 x 4-1/2
- 1 Exit Device (RHR-Active Door) - ED6400A x Newport N455 Trim
- 1 Exit Device (LHR Inactive Door) ED6400A
- 2 Door Closers DC2200
- 2 Wallstops 409
- 2 Silencers 608
- 2 Kick Plates
- 2 Mop Plates

## SET 18

### Corridor Double Doors Double Egress Rated

#### Double Egress Doors

Held open with magnetic holders and smoke detectors (furnished by others) Astragal furnished by door supplier. doors must fit within 5/16" of finish floor.

Each to have:

- 3 PR butts BB1168 4-1/2 x 4-1/2
- 2 Exit Devices ED6400A LHR
- 2 Door Closers Delayed Acting
- 1 Set Smoke Seals
- FS188 - 45-90 minute
- 2-Floor Sweeps FS188
- 2 Kick Plates
- 2 Silencers

## SET 19

### Corridor Double Doors - Double Egress Non Rated

#### Double Egress Doors

Each to have:

- 3 PR Butts BB1168 4-1/2 x 4-1/2
- 2 Exit Devices ED6400 LHR
- 2 Door Closers Delayed Acting
- 2 Kick Plates
- 2 Silencers

SET 20

Single Door Non Rated

Dutch Door

Each to have:

2 PR Butts 1279 Sec. Stud 4-1/2 x 4-1/2

1 Lockset CL3251-IC-NSD (Lower leaf)

1 Deadlock DL 4017-~~HS~~ (Upper leaf)

1 Flush Extension Bolt 555 - 6" Rod

1 Kick Plate

1 Mop Plate

1 Wallstop with hook

1 Wallstop

4 Silencers

SET 21

Hasp Lock

1 Padlock PD5000-IC-High Security

END OF SECTION

## SECTION 08800

### GLAZING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

A. Glass and glazing for hollow metal work, windows, glazed walls, doors.

##### 1.2 RELATED SECTIONS

- A. Section 08111 - Standard Steel Doors: Glazed doors.
- B. Section 08211 - Flush Wood Doors: Glazed doors.
- C. Section 08410 - Aluminum Entrances and Storefronts.
- D. Section 08520 - Aluminum Windows: Glazed windows.
- E. Section 10800 - Toilet and Bath Accessories: Mirrors.

##### 1.3 REFERENCES

- A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM C920 - Elastomeric Joint Sealants.
- E. ASTM C1036 - Flat Glass.
- F. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM E84 - Surface Burning Characteristics of Building Materials.
- H. ASTM E283 - Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.

- I. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- J. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
- K. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
- L. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
- M. ASTM E774 - Sealed Insulating Glass Units.
- N. FGMA - Glazing Manual.
- O. FGMA - Sealant Manual.
- P. Laminators Safety Glass Association - Standards Manual.
- Q. SIGMA - Sealed Insulated Glass Manufacturers Association.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with 1994 Uniform Building Code to a design pressure of 30 lb/sq ft (1.43 kPa) as measured in accordance with ASTM E330.
- B. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

#### 1.5 SUBMITTALS: Division 1 - Submittals: Procedures for submittals.

- A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- C. Samples: Submit two samples 12 x 12 inch in size, exemplifying glass units, coloration.

#### 1.6 SUBMITTALS FOR INFORMATION

- A. Division 1 - Submittals: Procedures for submittals.
- B. Certificates: Certify that Products meet or exceed specified requirements.

- C. Manufacturer's Certificate: Certify that sealed insulated environmental glass, meets or exceeds specified requirements.

## 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience approved by manufacturer.

## 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Conditions affecting products on site.
- B. Do not install glazing when ambient temperature is less than 50 degrees F.
- C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## 1.9 WARRANTY

- A. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
- B. Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

## PART 2 PRODUCTS

### 2.1 FLAT GLASS MATERIALS

- A. Manufacturers:
  - 1. Libbey Owens Ford Designation LOF
  - 2. Spectrum Glass Products
  - 3. Viracon
- B. Float Glass (Type FG-A): ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; 1/4 inch; 6 mm minimum thick.
- C. Safety Glass (Type FG-B): ASTM C1048, Kind FT fully tempered, Condition A uncoated. Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; 1/4 inch (6.0 mm) thick.

- D. Tinted Glass (Type FG-C): Float type, heat strengthened light reducing in grey color; light transmittance of 42 percent, shading coefficient of 0.66, 6 mm minimum thick.

## 2.2 SEALED INSULATING GLASS MATERIALS

- A. Manufacturers:
  - 1. Libbey Owen Ford Designation LOF
  - 2. Spectrum Glass Products, Inc. Designation
  - 3. Viracon
- B. Insulated Glass Units (Type SG-A): ASTM E774 and E773; double pane with silicone sealant edge seal; outer pane of grey tinted glass, inner pane of clear glass, purge interpane space with dry hermetic air; total unit thickness of inch (25 mm).
- C. Edge Seal Construction: Stainless steel, bent and soldered mitered and spigoted corners.

## 2.3 GLAZING ACCESSORIES

- A. Setting Blocks: ASTM C864 Option I Neoprene, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: ASTM C864 Option I, Neoprene, 50 to 60 Shore A durometer hardness, minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify that openings for glazing are correctly sized and within tolerance.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

### 3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Perform installation in accordance with ASTM C804 for solvent release sealants.

### 3.3 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.

### 3.4 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

### 3.5 MANUFACTURER'S FIELD SERVICES

- A. Glass and glazing product manufacturers to provide field surveillance of the installation of their Products.
- B. Monitor and report installation procedures, noting unacceptable conditions.

### 3.6 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

### 3.7 PROTECTION OF FINISHED WORK

- A. Protect installed work as noted hereafter.
- B. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION



## SECTION 08921

### VERTICAL BUTT-GLAZED CURTAIN WALL SYSTEM

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Aluminum tube framing system with vertical butt-glazed vision glass and operable vents.
- B. Perimeter sealant.

##### 1.2 RELATED SECTIONS

- A. Section 04230 - Veneer Masonry System: Preparation of adjacent work to receive work of this section.
- B. Section 04255 - Nonbearing Masonry Veneer/Steel Stud Walls: Preparation of adjacent work to receive work of this Section.
- C. Section 04311 - Concrete Masonry Units: Preparation of adjacent work.
- D. Section 05500 - Metal Fabrications: Metal fabricated attachment devices.
- E. Section 07900 - Joint Sealers: System perimeter sealant and back-up materials.
- F. Section 08800 - Glazing.
- G. Section 08410 - Aluminum Entrances and Storefronts: Entrance doors, frames, and glazed lights.
- H. Section 08710 - Door Hardware: Mortised hardware reinforcement requirements affecting curtain wall framing members.
- I. Section 08800 - Glazing.

##### 1.3 REFERENCES

- A. AA (Aluminum Association) - Designation System for Aluminum Finishes.
- B. AAMA (American Architectural Manufacturers' Association) - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

- C. AAMA - Aluminum Curtain Wall Design Guide Manual.
- D. AAMA - Curtain Wall Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.
- E. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- F. AAMA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- G. AAMA 1502.7 - Test Method for Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
- H. AAMA FC-1 - Field Check of Metal Curtain Walls for Water Leakage.
- I. ASCE 788 - Calculation of Wind Loads.
- J. ASTM B209/B209M - Aluminum and Aluminum-Alloy Sheet and Plate.
- K. ASTM B221/B221M - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- L. ASTM E283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- M. ASTM E330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- N. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- O. ASTM E1105 - Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

#### 1.4 SYSTEM DESCRIPTION

- A. Curtain Wall System: Tubular aluminum sections with self supporting framing, factory prefinished, vision glass, operable vents; related flashings, anchorage and attachment devices.
- B. System Assembly: Site assembled.

## 1.5 PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with local uniform building code to a design pressure of 31 lb/sq ft (1.52 kPa).
- B. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with local uniform building code.
- C. Deflection: Limit mullion deflection to 3/4 inch (19 mm) L/240 with full recovery of glazing materials.
- D. System Assembly: Accommodate without damage to system, components or deterioration of seals, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, tolerance of supporting components, a mid-span slab edge deflection of one inch (25.4 mm).
- E. Thermal Resistance of Wall System (Excluding Vision Areas): R of 1.53 (RSI of .27).
- F. Air Infiltration: Limit air infiltration through assembly to 0.06 cfm/min/sq ft (0.03 l/s/sq m) of wall area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with ASTM E283.
- G. Condensation Resistance Factor: CRF of 55. when measured in accordance with AAMA 1502.7.
- H. Water Leakage: None, when measured in accordance with ASTM E331.
- I. Expansion / Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental affect to system components.
- J. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- K. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
- L. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

## 1.6 SUBMITTALS FOR REVIEW

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow drainage diagrams.
- C. Design Data: Provide framing member structural and physical characteristics, calculations, dimensional limitations.
- D. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
- E. Submit two samples 4 x 6 inches (100.16 x 150.4 mm) in size exemplifying prefinished aluminum surface, specified glass [units], insulated infill panels, glazing materials illustrating edge and corner.

## 1.7 SUBMITTALS FOR INFORMATION

- A. Division 1 - Submittals: Procedures for submittals.
- B. Test Reports: Submit substantiating engineering data, test results of previous tests [by independent laboratory] which purport to meet performance criteria, and other supportive data.
- C. Installation Data: Special installation requirements.

## 1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual. Maintain one copy copies on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum six (6) years documented experience approved by manufacturer.
- D. Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

## 1.9 DELIVERY, STORAGE, AND PROTECTION

- A. Handle work of this Section in accordance with AAMA - Curtain Wall Manual #10.
- B. Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and after installation of sealants.

## 1.11 WARRANTY

- A. Provide a five year warranty to include coverage for complete system for failure to meet specified requirements.

# PART 2 PRODUCTS

## 2.1 CURTAIN WALL SYSTEM

- A. Manufacturers:
  - 1. Cupples Products, Inc., 10733 Sunset Office Drive, St. Louis, MO 63127-1022
  - 2. EFCO Corporation, 1000 County Road, Monett, MO 65708, Phone: (800) 221-4169.
  - 3. Kawneer Company, Inc., Technology Park, Atlanta, Georgia 300923954, Phone: (404) 449-5555.

## 2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221/B221M.
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Fasteners: Stainless steel.

## 2.3 COMPONENTS

- A. Mullion Profile: As indicated on the documents; thermally broken with interior tubular section insulated from exterior pressure plate; matching stops and pressure plate of sufficient size and strength to provide bite on glass; drainage holes, deflector plates and

internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

- B. Operable Sash: Manufactured as an integral part of the butt-glazed curtainwall system and pre-glazed by the curtainwall manufacturer.

## 2.4 GLASS AND GLAZING MATERIALS

- A. Glass Materials: As specified in Section 08800 of Types described below:
  - 1. Glass in Exterior Lights: Type SG-A, both pane tempered.
  - 2. Glass in Entrance: Type SG-A both panes fully tempered.
  - 3. Glass for Operable Vent: Type SG-A, both panes fully tempered.
- B. Glazing Materials: As specified in Section 08800. Type to suit application to achieve weather, moisture, and air infiltration requirements.

## 2.5 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 07900 of Types described below.
- B. Perimeter Sealant: Silicone Sealant (Type S).
- C. Sealant Used Within System (Not Used for Glazing): Type as recommended by curtainwall manufacturer.

## 2.6 FABRICATION

- A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to ensure concealment from view.
- E. Reinforce interior horizontal head rail to receive blind track brackets and attachments.
- F. Reinforce framing members for external imposed loads.

## 2.7 FINISHES

- A. Finish Coatings: Conform to AAMA 605.2.

- B. Exterior and Interior Aluminum Surfaces: Two (2) coats high performance organic coating having a dry film thickness of 1.2 mils. Colors as follows:  
Exterior surface exposed surface shall match the Standing Seam Roofing color.  
Interior exposed surface shall match Serwin Williams “Spacious Gray” SW 1009.
- C. Apply one coat of bitumious paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this section.

### 3.2 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances [and align with adjacent work].
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install perimeter sealant Type S, Silicone, backing materials, and installation criteria in accordance with Section 07900.

### 3.3 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/8 inch (9.5 mm) and minimum of 1/4 inch (6 mm).

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Curtain wall and Glass product manufacturers to provide field surveillance of the installation of their Products.
- B. Monitor and report installation procedures, unacceptable conditions and environmental aspects.

### 3.5 ADJUSTING

- A. Adjust operating sash for smooth operation.

### 3.6 CLEANING

- A. Remove protective material from prefinished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

### 3.7 PROTECTION OF FINISHED WORK

- A. Protect finished Work from damage.

END OF SECTION



## SECTION 09111

### METAL STUD FRAMING SYSTEM

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Formed metal stud framing at interior locations.
- B. Framing accessories.

##### 1.2 RELATED SECTIONS

- A. Section 04320 - Veneer Masonry System: Veneer masonry supported by stud wall metal framing.
- B. Section 05400 - Cold-Formed Metal Framing: Structural load bearing metal stud framing.
- C. Section 06114 - Wood Blocking and Curbing: Rough wood blocking within stud framing.
- D. Section 09260 - Gypsum Board System: Wall sheathing.
- E. Section 07213 - Batt and Blanket Insulation: Insulation within framing members.
- F. Section 07900 - Joint Sealers.
- G. Section 09260 - Gypsum Board Systems: Metal studs for partitioning.

##### 1.3 REFERENCES

- A. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- C. ASTM A591 - Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.
- D. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
- E. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

- F. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
- G. Metal Framing Manufacturers Association (MFMA) - Guidelines for the Use of Metal Framing.
- H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

#### 1.4 SYSTEM DESCRIPTION

- A. Metal stud framing system for exterior wall metal fascia, with exterior sheathing specified in Section 09260, batt insulation specified in Section 07213, interior gypsum board specified in Section 09260.
- B. Metal stud framing system for interior walls, with batt type acoustic insulation specified in Section 09260 interior gypsum board specified in Section 09260.
- C. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- D. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

#### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate component details, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.
- B. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with GA 203, MFMA and ASTM C754.

#### 1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this section with minimum six years documented experience approved by manufacturer.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Dietrich Industries, Inc.
- B. Gold Bond Building Products Division, National Gypsum Co.
- C. Unimast Incorporated

### 2.2 STUD FRAMING MATERIALS

- A. Studs: ASTM A525 and C645, non-load bearing rolled steel, channel shaped, punched for utility access, as indicated on the drawings.
  - 1. Minimum Thickness: 25 gage.
- B. Runners: Of same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.
- C. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.
- D. Fasteners: GA 203. Self drilling, self tapping screws.
- E. Sheet Metal Backing: 20 gage (0.9 mm thick) galvanized steel for reinforcement of corners.
- F. Anchorage Devices: Power actuated.
- G. Acoustic Sealant: As specified in Section 09260.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

### 2.3 FINISHES

- A. Studs: Galvanize to G90 coating class.
- B. Tracks and Headers: Galvanize to G90 coating class.
- C. Accessories: Same finish as framing members. ASTM A123, hot dip galvanized to 1.25 oz/sq ft (380 gm/sq m).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that conditions are ready to receive work.
- B. Verify that rough-in utilities are in proper location.

### 3.2 ERECTION

- A. Align and secure top and bottom runners at 24 inches (600 mm) oc.
- B. Place two beads of acoustical sealant between runners and substrate to achieve an acoustical seal.
- C. Place two beads of acoustic sealant between studs and adjacent vertical surfaces to achieve an acoustical seal.
- D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- E. Install studs vertically at 16 inches (400 mm) oc.
- F. Align stud web openings horizontally.
- G. Secure studs to tracks using crimping method. Do not weld.
- H. Stud splicing not permissible.
- I. Fabricate corners using a minimum of three studs.
- J. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.
- K. Brace stud framing system rigid.
- L. Coordinate erection of studs with requirements of door frames, window frames, and install supports and attachments.
- M. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
- N. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and any equipment anchored to wall.

- O. Refer to Drawings for indication of partitions extend stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- P. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

### 3.3 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch.
- B. Maximum Variation of any Member from Plane: 1/8 inch.
- C. Maximum Variation From Plumb: 1/8 inch.

END OF SECTION



## SECTION 09206

### METAL FURRING AND LATHING

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Ceiling, framing.
- B. Metal lathing for wet plaster finish.
- C. Access panels.

##### 1.2 RELATED SECTIONS

- A. Section 05400 - Cold Formed Metal Framing.
- B. Section 07213 - Batt Insulation.
- C. Section 08111 - Standard Steel Frames: Installation of door frames.
- D. Section 08410 - Aluminum Entrances and Storefronts.
- E. Section 09220 - Portland Cement Plaster.

##### 1.3 REFERENCES

- A. ASTM C841 - Installation of Interior Lathing and Furring.
- B. ASTM C847 - Metal Lath.
- C. ASTM C933 - Welded Wire Lath.
- D. ASTM C1063 - Installation of Lathing and Furring for Portland Cement Plaster.
- E. GA-600 - Fire Resistance Design Manual.
- F. ML/SFA (Metal Lath/Steel Framing Association) - Specifications for Metal Lathing and Furring.

##### 1.4 SYSTEM DESCRIPTION

- A. Fabricate horizontal soffit framing to limit finish surface to 1/240 deflection under superimposed dead loads and wind uplift.

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations and finish as well as illustrating component design, material, and finish.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C841, ML/SFA, ASTM C1063.

1.7 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum four years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Gold Bond Building Products Div., National Gypsum Co.
- B. Keene Products from Metalex.
- C. Unimast Incorporated

2.2 FRAMING MATERIALS

- A. Furring Channels: Formed steel; minimum 24 gage thick, 3/8 inch deep x 3/4 inch high; length as required.
- B. Main Ceiling Channels: Formed steel; minimum 18 gage thick, 3/4 inch deep x 1-1/2 inch; length as required.
- C. Resilient Channels: Formed steel; minimum 24 gage thick; size and length as required, serrated face, hat shaped profile.
- D. Hangers: Galvanized steel of size and type to suit application, to rigidly support ceiling components in place, to deflection limits as indicated.
- E. Lateral Bracing: Formed steel; minimum 16 gage thick; size and length as required.
- F. Casing Bead: Formed zinc; minimum 26 gage thick; depth governed by plaster thickness; maximum possible lengths; expanded metal flanges, with square edges.



- G. Corner Bead: Formed zinc; minimum 26 gage thick; depth governed by plaster thickness; maximum possible lengths; expanded metal flanges, with radiused edge.
- H. Base Screed: Formed zinc; minimum [26] gage thick; depth governed by plaster thickness; maximum possible lengths; expanded metal flanges, with bevelled edge.
- I. Control and Expansion Joint Accessories: Formed zinc; minimum 26 gage thick; accordion profile, 2 inch expanded metal flanges each side.

## 2.3 LATHING MATERIALS

- A. Metal Lath: ASTM C847; flat diamond self furring mesh; 3.4 lb/sq ft of weight to suit application; backed with treated Kraft paper.
- B. Corner Mesh: Formed sheet steel; minimum 26 gage thick; perforated flanges shaped to permit complete embedding in plaster; minimum 2 inch size.
- C. Strip Mesh: Expanded metal lath, minimum 26 gage thick; 2 inch wide x 24 inch long.

## 2.4 ACCESSORIES

- A. Anchorage: Tie wire, nails, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- B. Polyethylene Sheet: Clear, 6 mil (0.15 mm) thick.
- C. Tie Wire: Annealed [galvanized] steel.

## 2.5 FINISHES

- A. Framing Materials: Galvanized.
- B. Hangers, Anchors, and Fastening Devices: Galvanized.
- C. Lath Materials: Galvanized.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify site conditions.
- B. Verify that surfaces conditions are ready to receive work.

### 3.2 WALL AND FURRED SPACE FRAMING

- A. Install lathing and furring for Portland cement plaster work in accordance with ASTM C1063.
- B. Erect furring channels at horizontally; secure with fasteners on alternate channel flanges at maximum 24 inches.
- C. Spacing furring channels maximum 16 inches on center, not more than 4 inches from floor and ceiling lines abutting walls.
- D. Space resilient channels at maximum 24 inches on center. Place joints over framing members.

### 3.3 CEILING AND SOFFIT FRAMING

- A. Install furring to height indicated. Erect after above ceiling or soffit work is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers to achieve deflection limits indicated.
- D. Space main carrying channels at maximum 72 inch centers; not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splice securely.
- G. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- H. Laterally brace suspension system.
- I. Erect resilient channels at maximum 24 inches on center. Rigidly secure in place.

### 3.4 CONTROL JOINTS

- A. Install control joints with back to back casing beads set 1/4 inch apart. Set both beads over 6 inch wide strip of polyethylene sheet to assist with air seal continuity.

- B. Control Joint Spacing: 10 feet oc and as indicated on reflected soffit plan.

### 3.5 LATHING

- A. Apply metal lath taut, with long dimension perpendicular to supports.
- B. Lap ends minimum [1] inch. Secure end laps with tie wire where they occur between supports.
- C. Lap sides of diamond mesh lath minimum 1-1/2 inches. Nest outside ribs of rib lath together.
- D. Attach metal lath to metal supports using tie wire at maximum 6 inches on center.
- E. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches (75 mm) from corner to form the angle reinforcement; fasten at perimeter edges only.
- F. Place corner bead at external wall corners; fasten at outer edges of lath only.
- G. Place base screeds at termination of plaster areas; secure rigidly in place.
- H. Place 4 inch wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.
- I. Place lath vertically above each top corner and each side of door and glazed frames to 6 inches above ceiling line.
- J. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- K. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

### 3.7 TOLERANCES

- A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
- B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION



## SECTION 09260

### GYPSUM BOARD SYSTEMS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Acoustical insulation.
- D. Gypsum board.
- E. Gypsum sheathing.
- F. Cementitious backer board.
- G. Taped and sanded joint treatment.

##### 1.2 RELATED SECTIONS

- A. Section 05400 - Cold Formed Metal Framing.
- B. Section 06114 - Wood Blocking and Curbing: Wood blocking for support of Toilet and Bath Accessories.
- C. Section 07213 - Batt Insulation: Thermal insulation.
- D. Section 08112 - Standard Steel Frames.
- E. Section 08305 - Access Doors: Metal access panels.
- F. Section 09111 - Metal Stud Framing System.
- G. Section 09206 - Metal Furring and Lathing.
- H. Section 09220 - Portland Cement Plaster.
- I. Section 09900 - Painting: Surface finish.
- J. Section 09955 - Vinyl Coated Fabric Wall Covering: Surface finish.

### 1.3 REFERENCES

- A. ASTM C36 - Gypsum Wallboard.
- B. ASTM C79 - Gypsum Sheathing Board.
- C. ASTM C442 - Gypsum Backing Board and Core Board.
- D. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.
- E. ASTM C514 - Nails for the Application of Gypsum Wallboard.
- F. ASTM C557 - Adhesive for Fastening Gypsum Wallboard to Wood Framing.
- G. ASTM C630 - Water Resistant Gypsum Backing Board.
- H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- I. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- J. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.
- K. ASTM C840 - Application and Finishing of Gypsum Board.
- L. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.
- M. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- N. ASTM E119 - Fire Tests of Building Construction and Materials.
- O. GA-201 - Gypsum Board for Walls and Ceilings.
- P. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
- Q. GA-600 - Fire Resistance Design Manual.

### 1.4 SYSTEM DESCRIPTION

- A. Acoustical Attenuation for Identified Interior Partitions: Required STC in accordance with ASTM E90 are indicated on the Drawings.

- B. Shaft Wall: Perform to the following:
  - 1. Air Pressure Within Shaft: Not applicable.

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate special details associated with fireproofing and acoustical seals.
- B. Product Data: Provide data on metal framing, gypsum board, joint tape.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, GA-201, GA-216 and GA-600. Refer to the installation guide of one of the listed manufacturers hereinafter for installation of gypsum sheathing.

1.7 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum five years documented experience approved by manufacturer.

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies in conjunction with Section 05400 and 09111 as follows:
  - 1. Fire Rated Partitions: Listed assembly by UL
  - 2. Fire Rated Structural Column Framing: Listed assembly by UL.
  - 3. Fire Rated Structural Beam Framing: Listed assembly by UL.
  - 4. Fire Rated Shaft Wall Requirements: two hour in accordance with UL listed assembly as noted on drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS - GYPSUM BOARD SYSTEM

- A. Acceptable manufacturers offering equivalent products.
  - 1. Georgia Pacific Corp.
  - 2. Gold Bond Building Products Div., National Gypsum Co.
  - 3. United States Gypsum Company

## 2.2 FRAMING MATERIALS

- A. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel, 25 gage 0.55 mm) thick, C shape.
- B. Furring, Framing and Accessories: ASTM C645. GA-216 and GA-600.
- C. Fasteners: ASTM C1002.
- D. Anchorage to Substrate: Tie wire, nails, screws and other metal supports, of type and size to suit application; to rigidly secure materials in place.

## 2.3 GYPSUM BOARD MATERIALS

- A. Standard Gypsum Board: ASTM C36; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered edges.
- B. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered edges.
- C. Moisture Resistant Gypsum Board: ASTM C630; 5/8 inch (16 mm) thick, maximum permissible length; ends square cut, tapered and beveled edges.
- D. Gypsum Sheathing Core Board (faced both sides with fiberglass mat): Conform to ASTM C79 and in accordance with ASTM C1177 with glass mats both sides and long edges. Size: 1/2" (13mm) thick by 4' by 8', 9' or 10'. Flame spread O, smoke developed O, when tested in accordance with ASTM E 84.
- E. Gypsum Core Board: ASTM C442, 1 inch (25 mm) thick, maximum permissible length; square edges, ends square cut.
- F. Cementitious Backing Board: High density, glass fiber reinforced, 1/2 inch (13 mm) thick; 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.

## 2.4 ACCESSORIES

- A. Acoustical Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness as required to fill the cavity of the partition where indicated.
- B. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- C. Corner Beads: Metal.
- D. Edge Trim: See drawing for type required.



- E. Joint Materials: ASTM C475; GA 201 and GA 216; reinforcing tape, joint compound, adhesive, and water.
- F. Fasteners: ASTM C1002, Type S12.
- G. Building paper: No. 15, non perforated, asphalt saturated felt complying with ASTM D226, Type 1 or equivalent.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

#### 3.2 METAL STUD INSTALLATION

- A. Install studs in accordance with ASTM C754 or manufacturer's instructions also, see Section 09111 - Metal Stud Framing System.
- B. Metal Stud Maximum Spacing: 16 inches (400 mm) on center.
- C. Refer to Drawings for indication of partitions extend stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- D. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- E. Blocking: Nail wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, and toilet accessories.

#### 3.3 WALL FURRING INSTALLATION

- A. Erect furring channels horizontally; space maximum 16 inches (400 mm) on center, not more than 4 inches (100 mm) from floor and ceiling lines. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
- B. Erect free-standing metal stud framing tight to concrete masonry walls, attached by adjustable furring brackets in accordance with manufacturer's instructions.

### 3.4 FURRING FOR FIRE RATINGS

- A. Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

### 3.5 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: In accordance with manufacturer's installation instructions.

### 3.6 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C754.
- B. Coordinate location of hangers with other work.
- C. Install ceiling framing independent of walls, columns, and above ceiling work.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each end of openings.
- E. Laterally brace entire suspension system.

### 3.7 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.
- B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- C. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

### 3.8 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA-201, GA-216 and GA-600.
- B. Erect single layer standard gypsum board in most economical direction horizontal, with ends and edges occurring over firm bearing.
- C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.

- D. Erect exterior gypsum sheathing horizontally, with edges butted tight and ends occurring over firm bearing.
- E. Use screws when fastening gypsum board to metal furring or framing.
- F. Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions.
- G. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
- H. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.
- I. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- J. Place control joints consistent with lines of building spaces at 20 feet on centers or as directed.
- K. Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.
- L. Install backing board over metal studs in accordance with manufacturer's instructions.

### 3.9 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch (0.8 mm).
- C. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
- D. Tape joints and corners of cementitious backing board.

### 3.10 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION



## SECTION 09306

### FLOOR TILE

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Ceramic and Porcelain tile floor and base finish using the thinset and mortar bed application method.
- B. Threshold at door opening.

##### 1.2 RELATED SECTIONS

- A. Section 07900 - Joint Sealers: Mildew resistant sealant.
- B. Section 09307 - Wall Tile.
- C. Section 15430 - Plumbing Specialties: Floor drains.
- D. Section 15440 - Plumbing Fixtures: Shower pan receptor.

##### 1.3 REFERENCES

- A. ANSI A108.1 - Installation of Ceramic Tile with Portland Cement Mortar.
- B. ANSI A108.3 - Quarry Tile and Paver Tile Installed With Portland Cement Mortar.
- C. ANSI A108.4 - Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
- D. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- E. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy.
- F. ANSI A108.8 - Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout.
- G. ANSI A108.10 - Installation of Grout in Tilework.
- H. ANSI A118.1 - Dry-Set Portland Cement Mortar.

- I. ANSI A118.4 - Latex-Portland Cement Mortar.
- J. ANSI A118.5 - Chemical Resistant Furan Mortars and Grouts for Tile Installation.
- K. ANSI A118.6 - Ceramic Tile Grouts.
- L. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
- M. ANSI A137.1 - Standard Specifications for Ceramic Tile.
- N. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.
- 1.4 SUBMITTALS: Submit under provisions of Division 1.
  - A. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.
  - B. Product Data: Provide instructions for using adhesives and grouts.
  - C. Samples: Mount tile and apply grout on two plywood panels, 12 x 12 inch in size illustrating pattern, color variations, and grout joint size variations.
  - D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements. ANSI A137.1.
- 1.5 MAINTENANCE DATA
  - A. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
- 1.6 QUALITY ASSURANCE
  - A. Perform Work in accordance with ANSI A137.1.
  - B. Conform to TCA Handbook, ANSI A108.1, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.10.
- 1.7 QUALIFICATIONS
  - A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.
  - B. Installer: Company specializing in performing the work of this section with minimum four years documented experience.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain 50 degrees F (10 degrees C) during installation of mortar materials.

## PART 2 PRODUCTS

### 2.1 TILE MANUFACTURERS

- A. American Olean Tile Co., Inc.
- B. Dal-Tile Corp.
- C. Florida Tile Industries, Inc.

### 2.2 CERAMIC TILE MATERIALS

- A. Ceramic Mosaic Floor Tile: TCA A137.1, conforming to the following:

1.	Moisture Absorption	0 to 0.5 percent
2.	Size	2 x 2 x 1/4 inch
3.	Shape	square
4.	Edge	cushioned
5.	Surface Finish	unglazed slip resistant
6.	Color	as selected

### 2.3 Porcelain Materials

- A. Porcelain Pavers: ANSI A137.1, conforming to the following:

1.	Moisture Absorption	0.06 to 0.3 percent
2.	Size	12 x 12 x 5/16 inch
3.	Shape	square
4.	Edge	square

- |    |                |                        |
|----|----------------|------------------------|
| 5. | Surface Finish | unpolished/split stone |
| 6. | Color          | as scheduled           |

2.4 Base Materials

- |    |                 |                  |
|----|-----------------|------------------|
| 1. | Length          | 2 x 2 x 1/4 inch |
| 2. | Height          | 4 inch (102 mm)  |
| 3. | Top Edge        | Bullnosed        |
| 4. | Internal Corner | Coved            |
| 5. | External Corner | Bullnosed        |

2.4 ADHESIVE MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div.
2. Laticrete International, Inc.
3. Mapei Corporation

B. Ceramic: Organic Adhesive, ANSI A136.1, Type I thinset bond type.

C. Porcelain: Epoxy floor adhesive: AO 2000 Epoxy adhesive, ANSI A118.3.

2.5 MORTAR MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div.
2. Laticrete International, Inc.
3. Mapei Corporation

B. Mortar Materials: ANSI A118.1 Dry Set, Portland cement, sand, latex additive, and water.

2.6 GROUT MATERIALS

A. Manufacturers:

1. Bostik Construction Products, Div., Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

B. Grout: ANSI A118.6, tile grout, color as selected.

C. Grout: ANSI A118.5, furan resin type, color as selected.



## 2.8 ACCESSORIES

- A. Thresholds: Marble complying with ASTM C 503 requirements, type, white color, honed finish, 2" x 3/4" inch size by full width of wall or frame opening, beveled one side, radiused edges from bevel to vertical face.

## 2.9 MORTAR MIX AND GROUT MIX

- A. Mix and proportion cementitious materials for site made slurry coat, mortar bed and bond coat.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.

### 3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean surfaces.
- C. Seal substrate surface cracks with filler.
- D. Apply conditioner to substrate surfaces in accordance with adhesive manufacturer's instructions.

### 3.3 INSTALLATION - THINSET METHOD

- A. Install adhesive tile, thresholds, and grout in accordance with manufacturer's instructions.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Place thresholds edge strips at exposed tile edges, locations indicated.
- D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- F. Sound tile after setting. Replace hollow sounding units.

- G. Keep control joints free of adhesive or grout. Apply sealant to joints.
- H. Allow tile to set for a minimum of 48 hours prior to grouting.
- I. Grout tile joints.
- J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### 3.3 INSTALLATION - MORTAR BED METHOD - WHERE INDICATED

- A. Install mortar bed, tile and grout in accordance with manufacturer's instructions.
- B. Apply mortar bed over indicated surfaces to a thickness of 1-1/4 inch.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- D. Place thresholds edge strips at exposed tile edges. Locations indicated.
- E. Cut and fit tile tight to penetrations through tile. Ensure finish trim will cover cut tile edges. Form corners and bases neatly. Align floor, base joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control joints free of mortar or grout. Apply sealant to joints.
- I. Allow tile to set for a minimum of 48 hours prior to grouting.
- J. Grout tile joints.
- K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### 3.4 CLEANING

- A. Clean tile and grout surfaces.

### 3.5 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over finished floor surface for 4 days after installation.

### 3.6 EXTRA STOCK

- A. Provide five boxes of extra stock for each type and color of flooring material used to the owner. Include an appropriate amount and color of grout used for each color of floor tile to cover the five boxes of extra stock considering 10% waste. Additionally, provide the appropriate amount of mastic to adhere the five boxes of extra stock. Include 50 LF of any type or color of transition strip used.

END OF SECTION



## SECTION 09307

### WALL TILE

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Ceramic tile wall finish using the thinset application method.
- B. Cementitious backing board.

##### 1.2 RELATED SECTIONS

- A. Section 04311 - Concrete Masonry Units: Wall substrate surface.
- B. Section 09220 - Portland Cement Plaster: Base coat for tile finish.
- C. Section 07900 - Joint Sealers: Mildew resistant sealant.
- D. Section 09306 - Floor Tile.
- E. Section 15440 - Plumbing Fixtures: Shower pan receptor.

##### 1.3 REFERENCES

- A. ANSI A108.1 - Installation of Ceramic Tile with Portland Cement Mortar.
- B. ANSI A108.3 - Quarry Tile and Paver Tile Installed With Portland Cement Mortar.
- C. ANSI A108.4 - Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
- D. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- E. ANSI A108.10 - Installation of Grout in Tilework.
- F. ANSI A118.1 - Dry-Set Portland Cement Mortar.
- G. ANSI A118.4 - Latex-Portland Cement Mortar.
- H. ANSI A118.5 - Chemical Resistant Furan Mortars and Grouts for Tile Installation.
- I. ANSI A118.6 - Ceramic Tile Grouts.

- J. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
- K. ANSI A137.1 - Standard Specifications for Ceramic Tile.
- L. ASTM C847 - Metal Lath.
- M. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate tile layout, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.
- B. Product Data: Provide instructions for using adhesives and grouts.
- C. Samples: Mount tile and apply grout on two plywood panels, 18 x 18 inch in size illustrating pattern, color variations, and grout joint size variations.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements. ANSI A137.1.

1.5 MAINTENANCE DATA

- A. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI A137.1.
- B. Conform to TCA Handbook, ANSI A108.1, ANSI A108.4, ANSI A108.5, ANSI A108.10.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum four years documented experience approved by manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather and stored under cover.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain 50 degrees F during installation of mortar materials.

## PART 2 PRODUCTS

### 2.1 TILE MANUFACTURERS

- A. American Olean Tile Co., Inc.
- B. Dal-Tile Corp.
- C. Florida Tile Industries, Inc.

### 2.2 CERAMIC TILE MATERIALS

- A. Ceramic Mosaic Wall Tile: ANSI A137.1, conforming to the following:
  - 1. Moisture Absorption 0 to 0.5 percent
  - 2. Size 4-1/4 x 4-1/4 x 1/4 inch
  - 3. Shape square
  - 4. Edge cushioned
  - 5. Surface Finish glazed
  - 6. Color as selected

### 2.3 ADHESIVE MATERIALS

- A. Manufacturers:
  - 1. Bostik Construction Products, Div. Product: Hydroment
  - 2. Laticrete International, Inc.
  - 3. Mapei Corporation

- B. Organic Adhesive: ANSI A136.1, Type I thinset bond type for installation of ceramic tile on cement backer board or water-resistant gypsum board.

## 2.4 MORTAR MATERIALS

### A. Manufacturers:

1. Bostik Construction Products, Div. Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

- B. Mortar Materials: ANSI A118.4 Latex Modified, Portland cement, sand, latex additive, and water for installation of ceramic tile on C.M.U.

## 2.5 GROUT MATERIALS

### A. Manufacturers:

1. Bostik Construction Products, Div. Product: Hydroment
2. Laticrete International, Inc.
3. Mapei Corporation

- B. Grout: ANSI A118.6, tile grout, color as selected.

## 2.6 ACCESSORIES

- A. Membrane: No. 15 (6.9 kg) asphalt saturated felt.

- B. Backing Board: High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch (50 mm) wide coated glass fiber tape for joints and corners; Dens-Shield manufactured by Georgia Pacific Corporation.

## 2.7 MORTAR MIX AND GROUT MIX

- A. Mix and proportion cementitious materials for site made slurry coat, mortar bed and bond coat.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.



### 3.2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean surfaces.
- C. Seal substrate surface cracks with filler.

### 3.3 INSTALLATION - THINSET METHOD

- A. Install adhesive tile and grout in accordance with manufacturer's instructions.
- B. Install backing board over metal studs in accordance with board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- C. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base and wall joints.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- F. Form internal angles coved and external angles bullnosed.
- G. Install ceramic accessories rigidly in prepared openings.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control joints free of adhesive or grout. Apply sealant to joints.
- J. Allow tile to set for a minimum of 48 hours prior to grouting.
- K. Grout tile joints.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### 3.3 INSTALLATION - MORTAR BED METHOD

- A. Install mortar bed, tile, and grout in accordance with manufacturer's instructions.
- B. Install membrane; lap edges and ends.

- C. Apply mortar bed over concrete masonry units (CMU) surfaces to a thickness of 5/8 inch.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Form internal angles coved and external angles bullnosed.
- F. Cut and fit tile tight to penetrations through tile. Ensure finish trim will cover cut tile edges. Form corners and bases neatly.
- G. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or excess grout.
- H. Install ceramic accessories rigidly in prepared openings.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control joints free of mortar or grout. Apply sealant to joints.
- K. Allow tile to set for a minimum of 48 hours prior to grouting.
- L. Grout tile joints.
- M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

#### 3.4 CLEANING

- A. Clean work under provisions.
- B. Clean tile and grout surfaces.

#### 3.5 EXTRA STOCK

- A. Provide five boxes of extra stock for each type and color of wall tile material used to the owner. Include an appropriate amount and color of grout used for each color of wall tile to cover the five boxes of extra stock considering 10% waste. Additionally, provide the appropriate amount of mastic to adhere the five boxes of extra stock. Include 10 LF of any type or color of finish trim used.

END OF SECTION

SECTION 09511

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical panels.
- C. Non-fire rated assembly.

1.2 RELATED SECTIONS

- A. Section 07213 - Batt and Blanket Insulation.
- B. Section 08305 - Access Doors: Access panels.
- C. Section 10651 - Operable Panel Partitions: Acoustical partition system.
- D. Section 15375 - Sprinkler Systems: Sprinkler heads in ceiling system.
- E. Section 15936 - Air Outlets and Inlets: Air diffusion devices in ceiling system.
- F. Section 16510 - Interior Luminaires: Light fixtures in ceiling system.
- G. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire alarm components in ceiling system.
- H. Section 16770 - Public Address and System.

1.3 REFERENCES

- A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

- D. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- E. ASTM E1264 - Classification of Acoustical Ceiling Products.
- F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.
- G. UL - Fire Resistance Directory and Building Material Directory.

#### 1.4 SYSTEM DESCRIPTION

- A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

#### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to acoustical system.
- B. Product Data: Provide data on metal grid system components and acoustical units.
- C. Samples:
  - 1. Submit two samples full size illustrating material and finish of acoustical units.
  - 2. Submit two samples each, 12 inches long, of suspension system main runner, cross runner, edge trim, and suspension wires.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

#### 1.6 QUALIFICATIONS

- A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## 1.8 SEQUENCING

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustical units after interior wet work is dry.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS - SUSPENSION SYSTEM

- A. Armstrong World Industries, Inc.
- B. Chicago Metallic Corporation
- C. USG Interiors, Inc.

### 2.2 SUSPENSION SYSTEM MATERIALS

- A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T components die cut and interlocking.
- B. Grid Materials: Commercial quality cold rolled steel with galvanized coating. Cold rolled aluminum.
- C. Exposed Grid Surface Width: 15/16 and 9/16 inch.
- D. Grid Finish: White color as selected.
- E. Accessories: Stabilizer bars, clips, splices, edge moldings required for suspended grid system.
- F. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

### 2.3 MANUFACTURERS - ACOUSTICAL UNITS

- A. Armstrong World Industries, Inc.
- B. Celotex: The Celotex Corporation.

C. USG Interiors, Inc.

## 2.4 ACOUSTICAL UNIT MATERIALS

- A. Type I Acoustical Panels: ASTM E1264
1. Size: 24 x 24 inches
  2. Thickness: 3/4 inches
  3. Composition: Wet formed mineral fiber
  4. Density: 20 lbs/cu ft
  5. Light Reflectance: 75 percent
  6. NRC Range: .60 to .70
  7. STC Range: .35 to .39
  8. Fire Hazard Classification: 25
  9. Joint: Revealed
  10. Edge: Beveled tegular
  11. Surface Color: White
  12. Surface Finish: Factory applied vinyl latex paint; non-directional.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that layout of hangers will not interfere with other work.

### 3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636 and as supplemented in this section.
- B. Install system in accordance with ASTM E580.
- C. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- E. Locate system on room axis according to reflected plan.
- F. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- G. Supply hangers or inserts for installation to Section 09511 with instructions for their correct placement.
- H. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
- I. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are

spliced, avoid visible displacement of face plane of adjacent members.

- J. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- K. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- L. Do not eccentrically load system, or produce rotation of runners.
- M. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

### 3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Install units after above ceiling work is complete.
- D. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
- E. Cut panels to fit irregular grid and perimeter edge trim. Panel edge. Double cut and field paint exposed edges of tegular units.
- F. Where round obstructions occur, provide preformed closers to match edge molding.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### 3.5 EXTRA STOCK

A. Provide 100sf of extra stock for each type and color of ceiling tile used to the owner. Include 48= of main >T= runners and 48= of cross >T= members for each type of ceiling suspension system utilized.

END OF SECTION



## SECTION 09520

### ACOUSTICAL WALL TREATMENT

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. The work consists of furnishing labor, equipment and materials necessary to cover all areas shown on the drawings and specified herein with high impact aspen wood fiber wall panels.
- B. Acoustical systems shall be installed only by an approved acoustical contractor.
- C. The acoustical contractor shall furnish all labor materials and equipment necessary for the complete acoustical installation as shown in the drawings and as specified.

##### 1.2 DELIVERY AND STORAGE

- 1. Store this product in a dry place. Do not place in contact with the floors or walls. Wall panels must be protected against marring, soil or damage during storage and erection. Cover the bottom of panels with moisture proof materials and allow for circulation under cover to prevent condensation.  
CAUTION: High impact aspen wood fiber acoustical panels are interior acoustical panels and as all other interior acoustical products, must not be subjected to water.

##### 1.3 JOB CONDITIONS

- A. The building in which the high impact aspen wood fiber panels are to be erected should be closed in and, in cold seasons, heating should be in operation prior to installation.
- B. Materials should be located at the jobsite for at least 24 hours prior to application so that they can adjust to equilibrium in temperature and moisture.
- C. Panels are not recommended for installation where they can come into contact with free water.

#### 1.4 RECOMMENDATIONS

- A. High impact aspen wood fiber wall panel edges should always be beveled on the long side or covered with batten strips.
- B. The butting of end joints, square or beveled may require batten strips or field cutting to insure proper alignment.
- C. Additional technical information and design details on the use of high impact aspen wood fiber wall panels is available and may be obtained by contacting the manufacturer.

#### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.
- 2. Manufacturer's Data: Provide component description and manufacturer's standard color chart.

### PART 2 - PRODUCTS

#### 2.1 ACOUSTICAL MATERIALS

- A. The high impact aspen wood fiber acoustical materials shall be manufactured by a company engaged in this business.

##### 2.1.1 INTERIOR WALL PANELS

- A. All acoustical panels shall conform to Federal Specification SS-S-118B, Class A.
- B. High impact aspen wood fiber panels shall consist of wood fibers and hydraulic cement binder molded under control conditions of heat and pressure.
- C. The panels shall be high impact aspen wood fiber panels with a beveled edge that can be butted together or spaced apart as required. The panels shall have a noise reduction coefficient of .85. The thickness shall be 1"  $\ominus$ . The width shall be 23 $\frac{3}{4}$ "  $\ominus$ , 31 $\frac{3}{4}$ "  $\ominus$ , 47 $\frac{3}{4}$ "  $\ominus$ . The length shall be 4'  $\underline{\text{N}}$ , 5'  $\underline{\text{N}}$ , 6'  $\underline{\text{N}}$ , 7'  $\underline{\text{N}}$ , 8'  $\underline{\text{N}}$ , 9'  $\underline{\text{N}}$ , 10'  $\underline{\text{N}}$ , 11'  $\underline{\text{N}}$ , 12'  $\underline{\text{N}}$ . Batt insulation of 6"  $\ominus$  thickness shall be installed behind the panels.

- D. The material shall be ICBO, BOCA and/or SBCCI listed.

PART 3 - EXECUTION

3.1 INSTALLATION

3.2 MECHANICAL FASTENING TO FURRING

- A. Nominal 1"~~Ø~~ x 3"~~Ø~~ wood furring strips shall be secured to the wall, spaced 24"~~Ø~~ o.c. maximum, perpendicular to panel direction. Panels shall be fastened at each furring strip, screws spaced 240 o.c. maximum. Fasteners shall be flush to 1/16"~~Ø~~ countersunk.
- B. For new or remodeled interiors of commercial and institutional buildings, TECTUM bevel-butt panels are usually applied to walls by screwing to furring. A wood blocking of appropriate width should be used as a support on which to rest the TECTUM panels and serve as a nailer to baseboards or chair rails. Screws should provide not less than 1/2 ~~20~~ from panel edges.

END OF SECTION



SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.

1.2 RELATED SECTIONS

- A. Section 04311 - Concrete Masonry Units.
- B. Section 09260 - Gypsum Board System.

1.3 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM F1066 - Vinyl Composition Floor Tile.
- C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate borders, patterns, and direction of the grain.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples:
  - 1. Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.
  - 2. Submit two inch long samples of base material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Resilient flooring shall be stored in fully covered, well ventilated areas and protected from extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

## 1.7 MAINTENANCE DATA

- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

## 1.8 EXTRA STOCK

- A. Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 20 linear feet of each color shall be furnished.

## PART 2 PRODUCTS

### 2.1 MATERIALS - TILE FLOORING

- A. Vinyl Composition Tile: ASTM F1066:
  - 1. Size: 12 x 12 inch.
  - 2. Thickness: 1/8 inch.
  - 3. Design: marbleized.
  - 4. Manufacturers:
    - a) Tarkett
    - b) Mannington Resilient Floor
    - c) Azrock Industries

## 2.2 MATERIALS - BASE

A. Base: FS SS-W-40, Type I rubber; Rubber; top set coved:

1. Height: 4 inch
2. Thickness: 1/8 inch thick
3. Length: Roll.
4. Manufacturers:

- a) Flexco Company
- b) Roppe Corporation
- c) Johnsonite, Div of Duramex, Inc.

## 2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Flooring material; manufactured by Johnsonite.
- D. Cant Strip: Metal.
- E. Sealer and Wax: Types recommended by flooring manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

### 3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

### 3.3 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent when tile is placed.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- G. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Install flooring in pan type floor access covers. Maintain floor pattern.
- J. At movable partitions install flooring under partitions without interrupting floor pattern.

### 3.4 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### 3.5 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.



- B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

3.6 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION



SECTION 09651

RUBBER TILE FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rubber tile flooring.
- B. Rubber base.

1.2 RELATED SECTIONS

- A. Section 04311 - Concrete Masonry Units.
- B. Section 09260 - Gypsum Board System.

1.3 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM F1344, 1991, Class I.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate borders, patterns, and direction of the grain.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples:
  - 1. Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.
  - 2. Submit two inch long samples of base material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the site in original unopened packages, bundles or containers and with all labels intact. Resilient flooring shall be stored in fully covered, well ventilated areas and protected from extreme changes in temperature and humidity. Temperature and humidity in the storage area shall closely approximate the temperature and humidity of the rooms in which the flooring is to be installed.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

## 1.7 MAINTENANCE DATA

- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

## PART 2 PRODUCTS

### 2.1 MATERIALS - TILE FLOORING

- A. Rubber Tile Flooring: ASTM F1344, 1991, Class I-A.
  - 1. Size: 12 x 12 inches.
  - 2. Thickness: .125 inch.
  - 3. Design: marbleized.
  - 4. Manufacturers:
    - a) Burke Flooring Products Division of Burke Industries
    - b) Flexco Company
    - c) The R.C.A. Rubber Company

### 2.2 MATERIALS - BASE

- A. Base: FS SS-W-40, Type I rubber; Rubber; top set coved; premolded external corners:
  - 1. Height: 4 inch
  - 2. Thickness: 1/8 inch thick
  - 3. Length: Roll.

4. Manufacturers:

- a) Flexco Company
- b) Roppe Corporation
- c) Johnsonite, Div of Duramax, Inc.

- B. Base Accessories: Premolded end stops and external corners, of same material, size, and color as base.

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Flooring material; manufactured by Johnsonite.
- D. Cant Strip: Metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

3.3 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from container to ensure shade variations are consistent when tile is placed.

- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
- F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- G. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- I. Install flooring in pan type floor access covers. Maintain floor pattern.

#### 3.4 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

#### 3.5 CLEANING

- A. Remove access adhesive from floor, base, and wall surfaces without damage.
- B. Clean and buff floor and base surfaces in accordance with manufacturer's instructions.

#### 3.6 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on floor finish for 48 hours after installation.

### 3.7 EXTRA STOCK

A. Provide five boxes of extra stock for each type and color of flooring material used to the owner (same lot number). Include 25=LF for each color of base used. Additionally, provide the appropriate amount of mastic to adhere the five boxes of extra stock and base.

END OF SECTION





SECTION 09688

CARPET - GLUE DOWN

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet placed with glue down method.
- B. Accessories.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Floor substrate surface.
- B. Section 09650 - Resilient Flooring: Termination edging of adjacent floor finish.
- C. Section 09260 - Gypsum Board System : Wall materials to receive application of base.
- D. Section 09690 - Carpet Tile.

1.3 REFERENCES

- A. ASTM D2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.
- B. ASTM E84 - Surface Burning Characteristics of Building Materials.
- C. ASTM E648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- D. NFPA 253 - Test for Critical Radiant Flux of Floor Covering Systems.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet, and detail of conditions where there is a change of adjacent materials.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples:

1. Submit two samples 24 x 24 inch in size illustrating color and pattern for each carpet material specified.
2. Submit two 24 inch long samples of edge strip, base gripper, and material for each color specified.

- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and coordination.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer: Company specializing in installing carpet with minimum three years documented experience approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to NFPA 253 ASTM E648 Class II for flooring radiant panel test.
- B. Conform to ASTM D2859 for surface flammability ignition test.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for 3 days prior to installation in area of installation to achieve temperature stability.
- B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 1 days prior to, during and 24 hours after installation.

1.8 MAINTENANCE DATA

- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER - CARPETING

- A. Collins & Aikman/Infinity

- B. Mannington/Carthage/Mountain Brook
- C. Shaw/Groundworks/#16420 Crossroads

## 2.2 MATERIALS - CARPET

- A. Color See Schedule
- Pattern Infinity, Mark II, Style 1482.

### 1. Tufted Carpet: Conforming to the following criteria:

Yarn Size	1235/2
Pile Fiber	75% DuPont Solution Dyed Nylon: 25% CF Antron Legacy Nylon.
Static Control Fiber	Conductive Fiber
Max. Electrostatic Charge	1.4 Kv. @ 20 percent R.H.
Rows per Inch	9.5
Gage	1/13"
Wire Height	.117 inch
Pile Weight	20. oz/sq yd
Density Factor	123,076 kilotex
Stitch Count	114 (9.5 x 12)
Light Fastness	5
Primary Backing Material	Woven Synthetic
Primary Backing Weight	3.5 oz/sq yd
Laminate	Sealant vinyl
Laminate Weight	51.59 oz/sq yd
Secondary Backing Material	Closed cell vinyl cushion
Secondary Backing Weight	51.19 oz/sq yd
Total Weight	74.69 oz/sq yd
Roll Width	6 ft

## 2.3 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesive: Compatible with carpet material. Recommended by carpet manufacturer. Releasable type, to be used when installing the carpet tiles where required.
- C. Edge Strips: plastic type, smooth finish, color as selected.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are smooth and flat with maximum variation of 1/4 inch in 10 ft (6 mm in 3 m), and are ready to receive work.

- B. Verify concrete floors are dry to a maximum moisture content of 7 percent; and exhibit negative alkalinity, carbonization, or dusting.

### 3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

### 3.3 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturers' instructions.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.
- C. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed. [Edge seam carpet at public areas.
- D. Locate seams in area of least traffic.
- E. Join seams by hand sewing method. Form seams straight, not overlapped or peaked, and free of gaps.
- F. Lay carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance. Provide monolithic color, pattern, and texture match within any one area.
- G. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- H. Cut and fit carpet around interruptions.
- I. Bind cut edges where not concealed by edge strips.
- J. Fit carpet tight to intersection with vertical surfaces without gaps.

- K. Where wall bases are scheduled, cut carpet tight to walls. Fit carpet tight to vertical interruptions, leaving no gaps.

#### 3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

#### 3.5 REMNANTS

- A. Remnants remaining from the installations, consisting of scrap pieces more than 2 (two) feet in dimension with more than 6 square feet total, shall be provided. Non-retained scraps shall be removed from the site.

END OF SECTION



SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

- A. Section 05500 - Metal Fabrication: Shop primed items.
- B. Section 15190 - Mechanical Identification.
- C. Section 16195 - Electrical Identification.

1.3 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.
- E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
- F. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.
- G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.
- H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data on all finishing products.
- B. Samples: Submit two samples, 12 x 12 inch in size illustrating selected colors for each color selected.
- C. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum four years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum six years documented experience approved by manufacturer.

1.7 FIELD SAMPLES

- A. Provide field sample panel, 3 feet x 5 feet wide, illustrating special coating color, texture, and finish.
- B. Locate where directed.
- C. Accepted sample may not remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:  
Product name or title of material.  
Product description (generic classification or binder type).  
Manufacturer's stock number and date of manufacture.  
Contents by volume, for pigment and vehicle constituents.  
Thinning instructions.  
Application instructions.  
Color name and number
- B. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32



degrees C), in ventilated area, and as required by manufacturer's instructions.

- C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints:  
45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish Finishes:  
65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers - Paint
  - 1. Devoe and Reynolds Co. (Devoe)
  - 2. The Glidden Company (Glidden)
  - 3. The Sherwin-Williams Company (S-W)
- B. Manufacturers - Transparent Finishes
  - 1. Devoe
  - 2. Glidden
  - 3. S-W

C. Manufacturers - Stain

1. Devoe
2. Glidden
3. S-W

D. Manufacturers - Primer Sealers

1. Devoe
2. Glidden
3. S-W

E. Manufacturers - Block Filler

1. Devoe
2. Glidden
3. S-W

2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

2.3 FINISHES

- A. Refer to schedule at end of section for surface finish and color schedule.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Plaster and Gypsum Wallboard: 12 percent.
  - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
  - 3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.
  - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.
  - 5. Concrete Floors: 8 percent.

### 3.2 PREPARATION

- A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect work of this section.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.
- G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

- H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- K. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- L. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- M. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- N. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- O. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- P. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied.
- Q. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

### 3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand wood and metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

### 3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section 15190 and Section 16195 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
- B. Paint shop primed equipment.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- E. Paint interior surfaces of air ducts, that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.
- F. Paint exposed conduit and electrical equipment occurring in finished areas.

- G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.5 CLEANING

- A. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

### 3.6 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications (Section 05500): Exposed surfaces of lintels, elevator pit ladders.
- B. Metal Stairs (Section 05510): Exposed surfaces of stringers, exposed vertical risers.

### 3.7 SCHEDULE - EXTERIOR SURFACES

- A. Pavement Markings:
  - 1. Two coats of traffic marking water base paint, white.
- B. Concrete or Concrete Block:
  - 1. One coat of primer sealer latex.
  - 2. Two coats of latex semi-gloss.
- C. Steel - Unprimed:
  - 1. One coat of modified alkyd primer (Barox P50).
  - 2. One coat of aliphatic urethane (Devthane 369) gloss.
- D. Steel - Shop Primed Railing:
  - 1. One coat of Universal modified alkyd, primer (Barox P50).
  - 2. One coat of aliphatic urethane (Devthane 369) gloss.

E. Steel - Galvanized:

1. One coat galvanize primer.
2. Two coats of alkyd enamel, Eggshell.

3.8 SCHEDULE - INTERIOR SURFACES

A. Wood - Painted: Wood Doors Only

1. One coat of alkyd prime sealer.
2. Two coats of alkyd enamel, eggshell.

B. Concrete or Concrete Block

1. One coat of primer sealer latex.
2. Two coats of latex semi-gloss.

G. Steel - Unprimed:

1. One coat of alkyd primer.
2. Two coats of alkyd enamel, semi-gloss.

H. Steel - Primed:

1. Touch-up with alkyd primer.
2. Two coats of alkyd enamel, semi-gloss.

I. Steel - Galvanized:

1. One coat galvanize primer.
2. Two coats of alkyd enamel, semi-gloss.

J. Concrete Floors:

1. One coat of alkali resistant primer.
2. Two coats of alkyd floor enamel, gloss.

K. Gypsum Board:

1. One coat of alkyd primer sealer.
2. Two coats of alkyd enamel, eggshell.

L. Wall Surfaces Under Vinyl Wall Covering:

1. One coat of alkyd primer sealer.

M. Insulated Coverings - Canvas and Cotton:

1. One coat of alkyd primer sealer.
2. Two coats of alkyd enamel, eggshell.

3.9 EXTRA STOCK

- A. Provide one gallon of each type and color of paint installed. Each can to be marked to identify color, where used, and formula, all taken from the same lot as that installed.

END OF SECTION



SECTION 10105

VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surfaced metal chalkboards.
- B. Surfaced metal markerboards.
- C. Map and display rail.
- D. Trim, Chalkrail, and accessories.

1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board Systems: Substrate construction.
- B. Section 06114 - Wood Blocking and Curbing: Wood grounds.
- C. Section 04311 - Concrete Masonry Units: Substrate construction.

1.3 REFERENCES

- A. AHA A135.4 - Basic Hardboard.
- B. ASTM A424 - Steel Sheets for Porcelain Enameling.
- C. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- D. ASTM B209 - Aluminum-Alloy Sheet and Plate.
- E. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- F. ASTM C36 - Gypsum Wallboard.
- G. ASTM C208 - Insulation Board (Cellulose Fiber) Structural and Decorative.
- H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- I. FS CCC-W-408 - Wall Covering, Vinyl-Coated.

- J. FS L-P-1040 - Plastic Sheets and Strips, Polyvinyl Floride.
  - K. HPMA HP - Hardwood and Decorative Plywood.
  - L. NPA A208.1 - Mat Formed Wood Particleboard.
  - M. PEI (Porcelain Enamel Institute) - Performance Specifications for Porcelain Enamel Chalkboards.
  - N. PS 1 - Construction and Industrial Plywood.
- 1.4 SUBMITTALS: Submit under provisions of Division 1.
- A. Shop Drawings: Indicate wall elevations, dimensions, joint locations.
  - B. Product Data: Provide data on markerboards, map and display rail, trim and accessories.
  - C. Samples: Submit two samples 6 x 6 inch (152 x 152 mm) in size illustrating materials and finish, color of markerboard and trim.
- 1.5 OPERATION AND MAINTENANCE DATA
- A. Maintenance Data: Include data on regular cleaning, and stain removal.
- 1.6 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- 1.7 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.
- 1.8 WARRANTY
- A. Warranty: Include coverage of markerboard surface from discoloration due to cleaning, crazing or cracking, and staining.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Claridge Products and Equipment, Inc. Product: LCS Writing System
- B. Greensteel, 29 S. Laring Ave., Dixonville, PA Product: Dry Markerboard
- C. Carolina Chalkboard, Landis, N.C. Product: Vitraseel Dry Markerboard

### 2.2 MARKERBOARD MATERIAL

- A. Sheet Steel: ASTM A526, galvanized to G90 designation.

### 2.3 CORE AND FRAME MATERIALS

- A. Plywood: APA Structural I, Grade C-D birch species.
- B. Foil Backing: Aluminum sheet, .015" (0.38 mm) thick.
- C. Frame and Chalkrail: Aluminum extrusions, ASTM B221, 6061 alloy, temper.

### 2.4 ACCESSORIES

- A. Adhesives: Type used by manufacturer.
- B. Map Supports: Formed aluminum sliding hooks, to fit map rail.
- C. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.
- D. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.

### 2.5 FABRICATION - MARKERBOARDS

- A. Outer Face Sheet: Steel, 24 gage (0.6 mm) thick.
- B. Core: Plywood, 3/8 inch (13 mm) thick.
- C. Backing Surface: Aluminum sheet, 0.015 inch (0.4 mm) thick.
- D. Splice Joint: Concealed spline of sheet steel.

2.6 FABRICATION - DISPLAY RAIL (NO. 51 MAP AND DISPLAY RAIL)

- A. Heavy gauge extruded aluminum with insert of 1/4 inch, (6 mm) thick. Provided with No. 51M display hook and map rail ends.

2.7 FABRICATION - FRAME AND TRIM

- A. Aluminum Frame: Of straight profile; exposed fasteners, map rail with cork insert separate of markerboard and surfaces.
- B. Aluminum Chalkrail: Of No. 263 profile, one piece full length of markerboard, open ends; exposed fasteners.

2.8 FINISHES

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; White color.
- B. Cork Surface: Natural light brown cork.
- C. Aluminum Frame, Chalkrail, and Accessories: Mill finish natural aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
- B. Verify flat wall surface for frameless adhesive applied type.

3.2 INSTALLATION

- A. Install markerboards and map and display rail, in accordance with manufacturer's instructions.
- B. Establish bottom of perimeter frame above finished floor by indications on drawings.
- C. Secure units level and plumb.
- D. Markerboards: Butt panels tight with concealed spline to hairline joint.

### 3.3 CLEANING

- A. Clean markerboard surfaces in accordance with manufacturer's instructions.
- B. Cover markerboard surfaces with protective cover, taped to frame.

END OF SECTION



## SECTION 10160

### METAL TOILET COMPARTMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Metal toilet compartments, floor mounted head rail braced.
- B. Urinal screens; wall mounted with floor to ceiling pilaster brace.

##### 1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board System: Framing and plates within walls.
- B. Section 10800 - Toilet and Bath Accessories.

##### 1.3 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM A424 - Steel Sheet for Porcelain Enameling.
- D. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- E. FS RR-P-1352 - Partitions, Toilet, Complete.

##### 1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Samples: Submit two samples of partition panel sheet, 12 x 12 inch in size illustrating panel finish, color, and sheen.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code for access for the handicapped.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.7 COORDINATION

- A. Coordinate the work with placement of support framing and anchors in wall and ceiling.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Global Steel Products Corp.
- B. Monarch Toilet Partitions, Inc.
- C. Sanymetal Products Co.

2.2 MATERIALS

- A. Steel Sheet: ASTM A526, with G90 zinc coating.

2.3 ACCESSORIES

- A. Pilaster Shoe: Formed chromed steel with satin finish, ASTM A167 type 304 stainless steel with No. 4 finish, 3 inch high, with adjustable screw jack.
- B. Head Rails: Hollow steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
- C. Attachments, Screws, and Bolts: Stainless steel; tamper proof type, heavy duty extruded aluminum brackets.



D. Hardware: Stainless steel:

1. Pivot hinges, gravity type, adjustable for door close positioning.
2. Nylon bearings.
3. Thumb turn door latch with exterior emergency access feature.
4. Door strike and keeper with rubber bumper.
5. Coat hook with rubber bumper.
6. Door pull for outswinging doors.

2.4 FABRICATION

A. Fabricate partitions in accordance with FS RR-P-1352.

B. Fabricate components of steel sheet as follows:

1. Panel and Door Faces: 20 gage.
2. Pilaster Faces: 18 gage.
3. Reinforcement: 12 gage.

C. Doors and Panels:

1. Thickness: 1 inch.
2. Door Width: 24 inch.
3. Door Width for Handicapped Use: 36 inch, out-swinging.
4. Height: 58 inch.

D. Pilasters: 1-1/4 inch (32 mm) thick, of sizes required to suit cubicle width and spacing.

E. Door, Panel, and Pilaster Construction: Sheet steel face, pressure bonded to sound deadening core, form and close edges, miter and weld corners, grind smooth.

F. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

## 2.5 FINISHING

- A. Clean, degrease, and neutralize panels.
- B. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.
- C. Single Color: Color as selected from manufacturer's, standard colors.
- D. Stainless Steel Surfaces: No. 4 finish.
- E. Exposed Steel Surfaces: Satin stainless.
- F. Non-ferrous Surfaces: Satin chrome plated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### 3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets with [tamper proof] through bolts and nuts. Locate head rail joints at pilaster center lines.
- E. Install 30 inch wide x 42 inch high stainless steel protective splash panels on partitions adjacent to urinals. Fasten with stainless steel screws spaced 8 inches.
- F. Anchor urinal screen panels to walls with two panel brackets and vertical upright consisting of pilaster anchored to floor and ceiling.

- G. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- H. Support pilasters from built-in framing using two adjustable hanging studs providing vertical leveling. Conceal ceiling fastenings with pilaster shoe.
- I. Equip each door with two hinges, one door latch, one coat hook and bumper.
- J. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.
- K. Field touch-up of scratches or damaged enamel finish will not be permitted.
- L. Replace damaged or scratched materials with new materials.

### 3.3 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

### 3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION



SECTION 10211

FIXED METAL WALL LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fixed louvers and frames.
- B. Insect screening.

1.2 RELATED SECTIONS

- A. Section 04320 - Veneer Masonry System: Prepared exterior wall opening.
- B. Section 04255 - Nonbearing Masonry Veneer/Steel Stud Walls: Supplementary framing for wall opening.
- C. Section 07900 - Joint Sealers.
- D. Section 15890 - Ductwork: Ductwork attachment to louver.

1.3 REFERENCES

- A. AMCA 500 (Air Movement Control Association) - Test Method for Louvers, Dampers, and Shutters.
- B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
- C. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- D. ASTM A527 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
- E. ASTM B209 - Aluminum-Alloy Sheet and Plate.
- F. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.4 PERFORMANCE REQUIREMENTS

- A. Louver: To permit passage of air at a face velocity of 400 ft / min without blade vibration or noise, with maximum static pressure loss of 0.15 inches.
- B. Louver: To permit 50 percent free area.

1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blackout areas required, and frames.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Samples: Submit two samples 8 x 8 inch (203 x 203 mm) in size illustrating finish and color of exterior and interior surfaces.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA Certification for intake exhaust louvers.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

- A. Coordinate the Work with installation of masonry flashings.

1.10 WARRANTY

- A. Provide twenty year warranty under provisions of Section 01700.
- B. Warranty: Include coverage for degradation of polyvinylidene fluoride.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. The Airolite Company                      Product Model CB6776.
- B. Airline Products Company              Product Model CXWD6-HP
- C. Construction Specialties, Inc.      Product Model A6155.

### 2.2 MATERIALS

- A. Aluminum: ASTM B221, 6063-T5 alloy, temper; extruded shape; prefinished with shop applied flouropolymer finish.

### 2.3 SCREENS

- A. Insect Screen: 18 x 16 size aluminum mesh, set in aluminum frame.

### 2.4 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Flashings: Of same material as louver frame. Sheet aluminum.
- C. Sealants: Exterior type specified in Section 07900.

### 2.5 FABRICATION

- A. Louver Panel Thickness: 6 inches (152 mm) deep, face measurements as indicated.
- B. Louver Blade Design: Drainable blades sloped at 45 degrees; reinforced with intermediate stiffeners, extruded aluminum (alloy 6063-T5) thickness of .081 inch (2.06 mm) minimum. Blades shall be joined to each jamb frame and vertical stiffening member with two fillet welds each 1" (25.4 mm) long produced with the Pulsed Gas Metal Arc Welding process (GMAW/MIG) with a minimum .125" (3.175 mm) throat. Frames shall be joined at each corner with a full (3.175 mm) throat. Manufacturer shall submit theoretical calculations prepared by a professional engineer specialized in the application of welding technology demonstrating that each weld will withstand minimum 526 pounds of force in shear.
- C. Louver Frame: Channel shape, welded corner joints, material thickness of .081 inch (2.06 mm) minimum.

- D. Intermediate Mullions: Concealed type of extruded aluminum, profiled to suit louver frame.
- E. Head and Sill Flashings: Extruded to required shape, single length in one piece per location.
- F. Screens: Install screen mesh in shaped frame, reinforce corner construction, shop install to louver with fasteners.

## 2.6 FINISHES

- A. Exterior and Interior Aluminum Surfaces, factory primed and finished after assembly, Screen. Prepainted finish of flouropolymer (a Kynar 500 (PVF2) resin coating) color as selected from manufacturers standard colors.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that electric power is available and of the correct characteristics.

### 3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install insect screen and frame to exterior of louver.
- F. Install insect screen and frame to intake louvers.
- G. Install perimeter sealant and backing rod in accordance with Section 07900.

### 3.3 CLEANING

- A. Strip protective finish coverings.



B. Clean surfaces and components.

END OF SECTION



## SECTION 10440

### SIGNS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Interior Signs
- B. Dimensional letters and numbers

##### 1.2 RELATED SECTION

- A. Section 03300 - Cast-In-Plate Concrete
- B. Section 06200 - Finish Carpentry
- C. Section 08111 - Std Steel Doors
- D. Section 08211 - Flush Wood Door
- E. Section 08800 - Glazing

##### 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

#### THE ALUMINUM ASSOCIATION, INCORPORATED (AA)

- AA 45 (1980) Designation System for Aluminum Finishes
- AA 46 (1978) Anodized Architectural Aluminum

#### AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 605.2 (1990) High Performance Organic Coatings on Architectural Extrusions and Panels

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI A10.3 (1985) Powder-Actuated Fastening Systems Safety Requirements
- ANSI B18.2.1 (1981) Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

ANSI B18.6.1 (1981) Wood Screws (Inch Series)

ANSI B18.6.2 (1972, R 1983) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws

ANSI B18.6.3 (1972, R 1983) Machine Screws and Machine Screw Nuts

ANSI B18.7 (1972, R 1980) General Purpose Semi-Tubular Rivets, Full Tubular Rivets, Split Rivets and Rivet Caps

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (1989) Structural Steel

ASTM A 123 (1989, Rev A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 (1982, R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 167 (1990) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 525 (1990) Steel Sheet, Zinc-Coated(Galvanized) by the Hot-Dip Process

ASTM B 26/B 26M (1988) Aluminum-Alloy Sand Castings

ASTM B 62 (1990) Composition Bronze or Ounce Metal Castings

ASTM B 108 (1987) Aluminum-Alloy Permanent Mold Castings

ASTM B 209 (1990) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (1990) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM C 1036 (1990) Flat Glass

ASTM D 3841 (1988) Glass-Fiber-Reinforced Polyester Plastic Panels

ASTM D 4802 (1988) Poly (Methyl Methacrylate) Acrylic Plastic Sheet

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1 (1990) Structural Welding Code Steel, Twelfth Edition

FEDERAL STANDARDS (FED-STD)

FED-STD-795 Uniform Federal Accessibility Standards

FEDERAL SPECIFICATIONS (FS)

FS FF-S-325 (Int Am. 3) Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

FS L-P-387 (Rev. A, Int Am. 2) Plastic Sheet, Laminated, Thermosetting (for Designation Plates)

FS FF-P-395 (Rev. C) Pin, Drive Guided and Pin Drive, Powder Actuated (Fasteners for Powder Actuated and Hand Actuated Fastening Tools)

FS FF-B-588 (Rev. D) Bolt, Toggle; and Expansion Sleeve, Screw

FS GGG-D-777 (Rev. B) Driver, Projectile Unit, Powder Actuated (High Velocity) (Above Water Only); Pin, Drive, Powder Actuated; and Cartridge, Powder Actuated Tool

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

SAE AMS 3611 (1986, Rev. C) Plastic Sheet, Polycarbonate General Purpose

1.4 SUBMITTALS: Submit the following in accordance with Section 01300, "Submittals."

A. Manufacturer's Catalog Data:

1. Interior room and direction plaque signs
2. Building directories
3. Manufacturers standard color chart and ADA contrast analysis chart.

Submit complete detail drawings including elevations, templates, erection and installation details for products listed below. Indicate dimensions, construction details, reinforcement, anchorage, and installation with relation to the building construction. A schedule showing the location of each type of sign shall be included.

B. Shop Drawings:

1. Interior room and direction plaque signs
2. Building directories

C. Certificates:

1. Aluminum sheet or plate
2. Aluminum castings
3. Cast bronze
4. Aluminum extrusions
5. Structural steel
6. Fiber-reinforced polyester
7. Glass
8. Acrylic sheet
9. Aluminum finishes

D. Samples:

1. Interior room, door, and direction plaque signs
2. ~~[Deleted] Cutout letter for illuminated sign~~ |
3. Two samples of manufacturer standard color chips for each material requiring color selection. Take samples from manufacturer's stock complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.5 EXTRA STOCK

A. Provide 4 blank plaques of sign Type 14. Submit prepaid coupon books for use by Owner for 100 each message strips for Directory and Window Sign Inserts. |

1. Provide computer generated coupon books complete with Owner's name, address, message strip background color, type style, and type code imprinted on each coupon.

2. Provide completed message strip return to Owner from coupon book order within ten working days of receipt of coupon by manufacturer.

## PART 2 PRODUCTS

- A. ADA Compliant Signage with raised graphics and grade II braille.

- B. Aluminum Alloy Products

1. ASTM B 209 for aluminum sheet or plate, ASTM B 221 for aluminum extrusions and ASTM B 26/B 26M or ASTM B 108 for aluminum castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 16 gauge thick. Provide aluminum castings of solid aluminum cast certified by AA 46 alloy designation B443.0. Where anodic coatings are specified, alloy shall conform to Aluminum Association's alloy designation 514.0 or A514.0.

- C. Aluminum Finishes

1. Provide exposed aluminum surfaces factory finished with anodic coating.
  - a. Anodic Coating
2. Clean and provide exposed aluminum surfaces with an anodized finish, AA 45.
3. Integral color-anodized designation AA-M10-C22-A42, Architectural Class I (0.7 mil or thicker). Color: as indicated.

- D. Cast Metal

1. Fabricate with square corners, flat faces, and accurate profiles. Remove burrs and rough spots. Belt polish faces to uniform high luster finish. File sides smooth with tool marks removed by fine abrasive grain air blasting, or other suitable method.
  1. Cast Aluminum - ASTM B 108.

- E. Fiber Reinforced Polyester (FRP)

ASTM D 3841, Type II, Grade 1, color: as indicated.

F. Acrylic Sheet

ASTM D 4802, Type III.

G. VINYL SHEETING FOR GRAPHICS: Minimum 0.003 inch film thickness. Provide a pre-coated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

H. EXPOSED ANCHORS AND FASTENERS: Compatible with sign material to which applied with matching color and finish. Protect against galvanic action or chemical interaction of adhesives.

1. Expansion Shields: FS FF-S-325, of Group, Type, Class, and Style suited for the purpose. Shields shall be recessed and shall be not less than 2 1/2 inches into concrete or masonry. Do not use devices of Groups IV, V, VI, and VII in sizes greater than 3/8 inch, unless so indicated.

2. Lag Screws and Bolts

ANSI B18.2.1.

3. Toggle Bolts

FS FF-B-588.

4. Bolts, Nuts, Studs, and Rivets

ANSI B18.2.1 or ANSI B18.7.

5. Powder Driven Fasteners

FS FF-P-395 or FS GGG-D-777. Provide only when permitted by ANSI A10.3. Follow safety provisions of ANSI A10.3.

6. Screws

ANSI B18.2.1, ANSI B18.6.1, ANSI B18.6.2, and ANSI B18.6.3.

I. FABRICATION AND MANUFACTURE

1. Workmanship: Drill or punch holes for bolts and screws. Drilling and punching shall produce clean, true lines and surfaces. Weld to structural steel in



accordance with AWS D1.1. Weld continuously along entire area of contact. Grind exposed welds smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Conceal fastenings where practicable. Items specified to be galvanized shall be hot-dip galvanized after fabrication. Galvanize in accordance with ASTM A 123 or ASTM A 153 or ASTM A 525. Form joints exposed to the weather to exclude water. Include drainage and weep holes required to prevent build-up of condensation.

2. Dissimilar Materials: Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, protect surfaces with two coats of polyamidoamine epoxy primer: Hi-Build Epoxoline II, Series 69 - Tnemec at 3.0 mils to 5.0 mils dry film thickness (DFT) each coat and finish with one coat of Series 75 - Endura-Shield: Tnemec, at 2.0 to 5.0 mils DFT to prevent galvanic or corrosive action.
3. Shop Painting: Apply one coat of modified alkyd rust-inhibitive primer, Series 10 Tnemec, to surfaces of miscellaneous metal work, except non-ferrous metal, corrosion-resisting steel, and zinc-coated work. Do not paint surfaces of items to be embedded in concrete. Upon completion of work, thoroughly recoat damaged surfaces. Prime coat steelwork immediately after cleaning.

L. INTERIOR PLAQUE SIGNS

1. Holder
  - a. Material: Integrally colored injection molded high impact plastic complete with mounting system: ready for insert installation.
  - b. Type: Square corners indicated in Schedule.  
MOUNTING HOLDERS TO SURFACE; SELECT TYPE OR TYPES Wall Mounting: MFH: Hole type for fastener attachment to wall surface.
  - c. Mounting:  
  
Wall or vertical surface  
Fastening: MFH
  - d. Size: As indicated on the drawings.

e. Color: A44 - Architectural Brown.

2. Insert

a. Integrally colored injection molded high impact plastic with computer generated photographic silkscreen process surface printing chemically bonded to self-aligning reveal insert material; insert corner same type as holder. MOUNTING INSERTS INTO HOLDERS; SELECT TYPE OR TYPES: MTM; 1/32" thickness magnetic tape. Use when inserts are subject to frequent change. VTM; Double sided vinyl tape mounting. Use when insert mounting is permanent. PL; PresLock rigid plastic fastener. Allows removal of inserts with special tool.

b. Mounting: VTM.

c. Sizes: Indicated in Schedule from manufacturer's standard sizes.

d. Color: A44 - Architectural Brown.

Schedule: e. Provide the following options indicated in  
Split inserts.  
Changeable slide insert.  
Window sign insert module.  
Window sign.

3. Graphics Application:

- a. Plaque Messages
- b. Message content shall be as follows.
- c. Typeface: Helvetica Medium
- d. Type size: as indicated.
- e. Background color: as indicated.
- f. Message color: White

4. Mounting: Mechanical Fasteners: Provide mounting holes in plaques and mounting screws using molly-bolts as necessary to secure to vertical surface.

M. BUILDING DIRECTORIES

- 1. Type: Surface Mounted Non Illuminated Wall Hung Directory.
- 2. Type: 2300 Series Directory with message strips.

3. Size: 26" total height including 4" header by 40-1/2" wide with display area approximately 23" high by 37-1/2" long.
3. Components: Housing:
  - a. Fabricated ASTM B221-90, 6063-T5 extruded aluminum alloy frame surrounding solid backing plate with PVC laminated to solid backing.
  - b. Color: #24 Wine.
  - c. Trim finish and color: AA M10C22A42 Duranodic Black 315.
  - d. Provide holes in back plate.
4. Doors:
  - a. Frame materials:  
Special: ASTM B455-89, extruded Alloy 385 architectural bronze, 0.125" thickness minimum; corners precision hairline mitered.
  - b. Door Profile: Square Accent Track suspended glass door.
  - c. Glazing:  
Optional: Optical quality E.I. du Pont de Nemours and Company, Inc; Lucite SAR 3/16" thickness super abrasion resistant clear acrylic plastic.
  - d. Hinges: Concealed continuous stainless steel hinge.
  - e. Furnish standard concealed keyless dual lock.
  - f. Finish and color: Alloy 280, Muntz metal C28000 Architectural Bronze.
5. Directory: Header Format:
  - a. Required. Architect will coordinate during shop drawing phase.
  - b. Type size: As specified.
  - c. Type style: OSB
  - d. Type code: Uppercase
  - e. Imprint color: #72 Bone White
6. Message Strips
  - a. 1/2" by 9" precision injection molded plastic strips with digital computer generated and photo silk-screened typography; provide sufficient blank strips to fill directory.
  - b. Type size: 1/4".
  - c. Type style: OSB.

- d. Type code: Initial caps.
  - e. Integral strip color: #A65 Desert Rose.
  - f. Imprint color: #72 Bone White.
  - g. Provide strips with self-aligning reveal and flex and stack ability for ease of installation and removal.
7. LetterGrip board and letters:
- a. Furnish manufacturer's standard grooved flexible rubberized vacuum formed plastic material especially setup for LetterGrip characters. Furnish one set interchangeable letters per module unit.
  - b. Module size: \*\*18"\*\*\* \*\*27"\*\*\* high by module length minus \*\*Specify # of columns message strips" message strip columns.
  - c. Integral letterboard color: Selected by Architect from manufacturer's standard \*\*Rubberized, exterior use: \*\*nine colors per unit. Plastic interior use: \*\*four colors per unit.
  - d. Changeable characters:
    - 1. Character height: \*\*5/8", \*\*3/4". \*\* 1-1/8"
    - 2. Character typography: Helvetica Medium.
    - 3. Type code: \*\*Uppercase. \*\*Lowercase. \*\*Numbers.\*\*
    - 4. Character color: Selected by Architect from manufacturer's standard six colors.
    - 5. Provide clear plastic storage box for each letter set.
8. Directory Unit Capacity:
- a. Capacity:
    - 1. Number of sides: one.
    - 2. Number of message strips per column: 1/2" wide strip: 50.
9. Fabrication
- a. Shop assembly:
    - 1. Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with shop drawings.
    - 2. Provide copy required on reviewed shop drawings; fill all slots without specific

copy with blank message strips.

10. Installation: Attach directories to supporting structures with concealed fasteners in accordance with manufacturer's instructions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine condition of locations and surfaces on which signs will be installed. Do not proceed with installation until defects or errors which would result in poor installation have been corrected.

### 3.2 INSTALLATION

- A. Install signs at locations as indicated. Ensure that signs are installed plumb and true, at mounting heights indicated, and by method shown or specified. Do not install signs on doors or other surfaces until finishes on such surfaces have been applied.
  1. Anchorage: Provide anchorage to ensure that signs are fastened securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide slotted inserts of types required to engage with anchors.

### 3.3 PROTECTION

- A. Protect work and adjacent work and materials against damage during progress of work until completion. Wrap finished work with paper, polyethylene film, or strippable waterproof tape for shipment and storage and protect from damage during installation.

### 3.4 ADJUST AND CLEAN

- A. Repair damage to signs incurred during installation. Replace signs which cannot be repaired to new condition. Clean glass, frames, and other sign surfaces, adjust hardware for proper operation.

PART 4 MANUFACTURERS

A. Acceptable Manufacturers

1. ASI Sign Systems, Inc.  
3890 W Northwest Huey  
Dallas, TX 75220  
1-800-ASI-SPEC
2. Interface International  
5320 Webb Parkway  
Lilburn, Georgia 30247  
(404) 921-5566
3. Apco Graphics  
388 Grant Street S.E.  
Atlanta, Georgia 30312-2227  
(404) 688-9000

END OF SECTION

SECTION 10508

METAL WARDROBE LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Locker units with hinged doors.
- B. Metal tops, and filler panels.
- C. Locker benches.

1.2 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Wood grounds and attachment strips.

1.3 REFERENCES

- A. ASTM A446/A446M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- B. ASTM A526/A526M - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

1.4 SUBMITTALS: Division 1 - Submittals: Procedures for submittals.

- A. Product Data: Provide data on locker types, sizes and accessories.
- B. Shop Drawings: Indicate locker plan layout, numbering plan and key codes.
- C. Samples: Submit two samples 3 x 6 inches (75 x 150 mm) in size, of each color selected; applied to specified base metal.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Transport, handle, store, and protect products.
- B. Protect locker finish and adjacent surfaces from damage.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. The Interior Medart Inc.  
P. O. Box 658, Greenwood, MS 38930  
Phone (800)647-7155 Model: Standard Lockers
- B. List Industries, Inc. 401 N.W. 12th Ave.  
Deerfield Beach, FL 33442  
Phone (305) 429-9155 Model: Standard Lockers
- C. Republic Storage System Co., Inc.  
1038 Belden Ave., N.E., Canton, Ohio 44705  
Phone (800) 477-1255 Model: Standard Lockers

### 2.2 MATERIALS

- A. Sheet Steel: ASTM A446 Grade D, ASTM A526 Coating  
Designation G90, stretcher leveled; to the following  
minimum thicknesses:
  - 1. Body and Shelf: 24 gage (0.6 mm)
  - 2. Door Outer Face: 16 gage (1.2 mm)
  - 3. Door Inner Face: 20 gage (0.9 mm)
  - 4. Door Frame: 16 gage (1.5 mm)
  - 5. Hinges: 14 gage (1.9 mm)
  - 6. Base: 20 gage (0.9 mm)
  - 7. Sloping Top: 20 gage (0.9 mm)
  - 8. Trim: 20 gage (0.9 mm)
- B. Locker size 18 inches wide, 21 inches deep, 72 inches high  
(Dust covers around the entire perimeter of the base will  
increase height by 6 inches to 78 inches) with dust covers  
around the base perimeter. Dust covers with sloped tops  
and end covers to preclude dust accumulation. End panels  
as required per attached room drawing. Maximum size of  
grouping units is three lockers per unit. Color is putty  
or light tan. Latch hook to have bevel on front upper edge  
to allow latch clip to ride up slope as door closes. Steel  
door frames of minimum 16 gauge metal with three hinges of  
minimum 14 gauge steel. Vertical members shall have an  
additional flange to form continuous door strike. Minimum  
gauge for top, bottom, shelves, sides, back and row ends if  
20 gauge steel. Eyelet for padlock must accept a 5/16"  
padlock shank, providing a secured locking three point  
latching mechanism. Lockers will be sequentially numbered  
with a plate beginning with #1. Locker will contain a  
single shelf at top with hanging rod and wall hooks on both  
sides. Louvers for circulation both at top and bottom.



Lockers are to be installed in the room with dust covers installed as per drawing attached.

- C. MC1 In Room #235, Training Aid Storage~~Double door wall locker~~

MC1: All Purpose Specialty Locker to be 36" wide, 22" deep, 72" high with continuous angle iron frame and three point security latch. Shelving to be adjustable and to include four shelves. Size: 30" wide x 21" deep x 78" high. Adjustable shelves and full width coat rod. Four shelves in the left side are adjustable on half inch centers. The locker shall come with a center half inch partition, hat rack and coat hook. The double louvered doors both shall have an inside mirror and allow for a padlock.

## 2.3 ACCESSORIES

- A. ~~[Deleted]For Each All Metal, Quiet Type Wardrobe Locker: Two double prong wall hooks, coat hanger bar, rubber bumper.~~
- B. Locker Benches: Stationary Free standing type; bench top of laminated maple species wood, stained, sealed and varnished; pedestals of chrome steel 17-1/2 inches (444.5 mm) high.

## 2.4 FABRICATION

- A. Locker Units:

Configuration and size as previously indicated.

Mounting: Surface mounted.

Base: Metal base.

Base Height: 4 inch (100 mm).

Top: Sloped metal with closures.

Locking: Equipped for built-in with master key cylinder locks.

Ventilation

Method: Louvered top and bottom frame and top and bottom of door.

Class Quiet

- B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
- C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

- D. Doors: Hollow channel construction, 1 3/16 inch (30 mm) thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
- E. Hinges: Two for doors under 42 inches (1 050 mm) high; three for doors over 42 inches (1 050 mm) high; weld securely to locker body and door.
- F. Integral Cylinder Lock: Five (5) pin type, master keyed; provide two keys per lock and four master keys.
- G. Number Plates: Provide oval shaped aluminum plates. Form numbers 1/2 inch (12.7 mm) high of block font style, in contrasting color.
- H. Provide ventilation openings at top and bottom of each locker.
- I. Form recess for operating handle and locking device.
- J. Finish edges smooth without burrs.
- K. Fabricate sloped metal tops, ends and closure pieces.
- L. Provide perforated end panels and filler strips.
- M. Fabricate 4 inch (100 mm) high steel bases with end closures.

## 2.5 FINISHES

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel.

~~B. Paint locker bodies and doors in contrasting colors.~~

~~C. Color: As scheduled in Color Schedule.~~

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

### 3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

- B. Install lockers plumb and square.
- C. Secure lockers with anchor devices to suit substrate materials at floor and/or wall. Minimum Pullout Force: 100 lb (445 N).
- D. Bolt adjoining locker units together to provide rigid installation.
- E. Install end panels, filler panels, sloped tops, and bases.
- F. Install accessories.
- G. Replace components that do not operate smoothly.
- H. Install benches with anchor devices to suite substrate material with minimum pullout force 100 lb.

### 3.3 CLEANING

- A. Cleaning installed work.
- B. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers and cabinets.
- B. Accessories.

1.2 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Wood blocking and shims.
- B. Section 09260 - Gypsum board System: Roughed-in wall openings.
- C. Section 09900 - Painting: Field paint finish.

1.3 REFERENCES

- A. ANSI/NFPA 10 - Portable Fire Extinguishers.
- B. ANSI/UL 92 - Fire Extinguisher and Booster Hose.
- C. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.
- D. UL 8 - Foam Fire Extinguishers.
- E. UL 154 - Carbon Dioxide Fire Extinguishers.
- F. UL 299 - Dry Chemical Fire Extinguishers.
- G. UL 626 - 2 1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.
- H. UL 1093 - Halogenated Agent Fire Extinguishers.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and location.
- B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

#### 1.5 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

#### 1.6 QUALITY ASSURANCE

- A. Provide units conforming with ANSI/UL 711.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 10 for requirements for extinguishers.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. J. L. Industries, 4450 W. 78th St. Circle  
Bloomington, MN 55435, phone 612-835-6850  
product: Fire Extinguisher Cabinets
- B. Larsen's Manufacturing Company  
7421 Commerce Lane N.E.  
Minneapolis, MN 800-527-7367  
Product: Fire Extinguisher Cabinets
- C. Potler-Roemer, 16833 Edwards Rd.,  
Cerritos, CA 90701-2417  
310-404-3753  
Product: Fire Extinguisher Cabinets

#### 2.2 CABINETS

- A. Metal Substrate: Formed sheet steel, primed galvanized; 18 gage (1.2 mm) thick base metal.

B. Configuration:

1.(FEC)Fire Rated Recessed Cabinet, sized to accommodate a U.L.4A 60B:C extinguisher and accessories.

2.(SFEC)Surface Mounted Cabinet, sized to accommodate a U.L.4A 60B:C extinguisher and accessories.

C. Trim Type: Flat face, fully recessed with 5/16 projection.

D. Door: 18 gage (1.2 mm) thick, reinforced for flatness and rigidity.

E. Door: Formed sheet steel, primed galvanized: 18 gauge. (1.2mm) thick base metal.

F. Cabinet Mounting Hardware: Appropriate to cabinet.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, white enamel finish.

B. Cabinet Signage: Fire Extinguisher.

2.4 EXTINGUISHER

Extinguishers shall be Multi-Purpose U.L. 4A60B:C.

2.5 FABRICATION

A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

B. Pre-drill for anchors.

C. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon roller type catch.

D. Weld, fill, and grind components smooth.

2.6 FINISHES

A. Cabinet Exterior Trim and Door: 18 Gage 304 Stainless Steel, #4 finish.

B. Cabinet Interior: Formed sheet steel, primed galvanized, White Baked enamel 18 gage (1.2mm) thick base metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, located from finished floor as indicated on the architectural drawing.
- C. Secure rigidly in place.
- D. Position cabinet signage on door to cabinets.

END OF SECTION



SECTION 10552

METAL STORAGE SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal storage shelving.

1.2 RELATED SECTIONS

- A. Section 09650 - Resilient Flooring: Substrate for metal storage shelving.
- B. Section 03300 - Cast-In-Place Concrete.

1.3 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Submit shop drawings showing location, ranges and extent of metal shelving systems. Show installation details at any special or non-standard conditions.
- B. Samples:
  - 1. Initial Selection Purposes: Submit manufacturer's standard size samples of colors and finishes.
  - 2. Verification Purposes: Submit 6" square samples of each color and finish required. Prepare from same material to be used for the work.
- C. Seismic Calculations: Submit detailed calculations of seismic forces for fully loaded shelving, indicating compliance with seismic design requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.
- B. Installer Qualifications: Firm specializing in metal storage shelving installation with not less than 2 years of experience in installation of metal storage shelving similar to that required for this project.

- C. Single Source Responsibility: Provide material produced by a single manufacturer for each shelving unit type.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

#### 1.6 WARRANTY

- A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and the Manufacturer, agreeing to repair or replace shelving units which fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Government may have against the Contractor under the Contract Documents.

- 1. Warranty period is 2 years after the date of Substantial Completion.

#### 1.7 MAINTENANCE

- A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.
- B. Replacement Materials: After completion of work, deliver not less than 2 of each type, color, and pattern of metal storage shelving, exclusive of material required to properly complete installation. Furnish 2% of accessory components as scheduled. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
  - Penco Products Inc.
  - Republic Storage Systems Co., Inc.

## 2.2 MATERIALS

- A. General: Minimum 20 gauge cold-rolled steel sheet metal, washed to receive powder coated baked enamel finish, higher gauge where indicated to provide appropriate loading capacity.
- B. Open Shelving: Provide heavy-duty open shelving units consisting of four upright corner pilasters, slotted to receive clips clipped together with shelves as indicated. Provide cross-braces laterally and at ends as required for stability with intended load. Shelves adjustable 1-1/2" on center. Provide 36" and 48" wide by 87" high units, unless otherwise indicated on drawings or in specifications.
- C. Shelf Depth: Provide shelving of standard depth as follows:

Standard Shelf Depth: As indicated on drawings 24" |

- D. Unit Configuration: Provide shelf units in configuration as follows:
- E. Standard Upright Assembly: provide complete unit equipped with four uprights; shelves and top designed to stand independently.
- F. Shelves: Provide units with number of shelves as indicated.
- G. Lateral Cross Braces: Minimum 12 gauge, 1" wide steel band, formed and punched at each end, capable of bolting to T sections. provide one pair of cross braces for every three sections of under 30"; two pairs for every two sections 30" and over.
- H. Crosswise Dividers: Minimum 24 gauge steel for shelves up to 18" high and 24" deep, minimum 20 gauge steel for shelves over 18" high and 24" deep, punched for attaching to shelves.
- I. Lengthwise Dividers: Steel gauge as required by shelf spacing.
- J. Bases: Channel-shaped to engage upright T sections with spring fasteners, minimum 20 gauge for 3" base, minimum 18 gauge for 6" base.

## 2.3 FINISHES

- A. Provide units in finishes and colors as selected by Architect from manufacturer's standard finishes and colors.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Inspect areas and conditions in which metal storage shelving will be installed. Verify locations of power feeds, positioning of exits and aisle ways and overall dimensions of space, including height and HVAC venting.

### 3.2 PREPARATION

- A. Prior to installation of shelving system, vacuum floor surface to remove dust, debris and loose particles. Resilient flooring wet mopped and dried or finish buffed. Verify that components, including size and finish are those specified before installing.

### 3.3 INSTALLATION

- A. Install shelving system and accessories after finishing operations, including painting have been completed. Install system to comply with final layout drawings, in strict compliance with manufacturers printed instructions. Position units level, plumb; at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation.

### 3.4 FIELD QUALITY CONTROL

- A. Remove and replace shelving components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

### 3.5 ADJUST

- A. Adjust components and accessories to provide visually acceptable installation.

### 3.6 CLEANING

- A. Immediately upon completion of installation, clean components and surfaces following manufacturer's recommended procedures.

- B. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

### 3.7 DEMONSTRATION

- A. Upon completion of installation of system, inspect and determine capability and compliance with requirements. Repair or replace units which are not functional. All shelves and/or accessories shall be smoothly in place with no visual buckling or non-alignment of parts evident.

### 3.8 PROTECTION

- A. Protect system against damage during remainder of construction period. Advise owner of additional protection needed to ensure that system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION



SECTION 10553

MAIL BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Multiple mail boxes with hinged and locked doors.

1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board System: Preformed opening.

1.3 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate locations, construction and anchorage details, dimensions, rough-in openings sizes, quantity and arrangement of box sizes.
- B. Product Data: Provide data for components.
- C. Samples: Submit two samples, 10x12 inch (250x300 mm) in size illustrating surface finishes.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and supports for mail boxes.
- E. Manufacturer's Certificate: Certify that Products meet or exceed. U.S. Postal Service requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings instructed by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. American Device Manufacturing Co., Steeleville, IL, Phone: 800 637 3763.

Model No.: Centurian 2600 R, Size D (compartment size: 12 2W X 10 2H x 15 1/2D, mounted 3 high, 10 across), 5 total Modules.

- B. Other acceptable manufacturers offering equivalent products, size and quantity to meet the criteria in paragraph >A= above.

1. Bommer, P.O. Box 187, Landrum, SC 29356, Phone: 312-384-3310.
2. Bommer, P.O. Box 187, Landrum, SC 29356, Phone 800-334-1543.
3. Salisbury Industries, 1010 E. 62nd St, Los Angeles, CA 90001, Phone 800-323-3003.

## 2.2 COMPONENTS

- A. Rear Loading Panel Frame: Aluminum with anodized finish.
- B. Box Door: Aluminum with anodized finish, 1/8" minimum thickness with concealed hinge pins. Doors shall be reinforced vertically along both sides and near center with integral ribs prepared for lock cylinder.
- C. Box Construction: Double walled, high strength sheet aluminum alloy with vertical stiffeners of formed aluminum. Pre-punch bolt holes in box for stack bolting to each other and anchoring to adjacent construction; label plates for identifying each box.
- D. Box Sizes: see 2.1, A above.
- E. Postal Box Locks: Five pin tumbler lock cylinder, two keys per box, cylinders master keyed to group with two master keys.
- D. Door identification to be an engraved plastic number tab supplied by owner.
- E. Mailboxes shall be supplied with snap-on-type aluminum trim of matching finish installed by contractor.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that prepared openings are ready to receive work.

### 3.2 INSTALLATION



- A. Install in accordance with manufacturer's instructions and U.S. Postal Service regulations.
- B. Install and secure boxes in position, neatly, and accurately stacked.
- C. Install doors and adjust to operate smoothly.
- D. Label rear of box same as front door label identification.

END OF SECTION



SECTION 10605

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wire mesh system for walls and ceiling.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Division 9 - Finishes.

1.3 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- E. ASTM A446 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical Quality).
- F. ASTM A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- G. ASTM A501 - Hot-formed Welded and Seamless Carbon Steel Structural Tubing.
- H. ASTM A510 - General Requirements For Wire Rods and Course Round Wire, Carbon Steel.
- I. ASTM A580 - Stainless and Heat-Resisting Steel Wire.
- J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- K. ASTM B211 - Aluminum-Alloy Bars, Rods, and Wire.
- L. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

- M. AWS D1.1 - Structural Welding Code.
- N. SSPC (Steel Structures Painting Council) - Painting Manual.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, framed openings, anchorage, welds, type and location of fasteners, and accessories or items required of related work.
- B. Product Data: Provide data for screen materials, finishes, and hardware.
- C. Samples: Submit two samples, 12" x 12" in size illustrating screen material. Submit samples of hinge latchset illustrating style, color, and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - Acorn Wire and Iron Works, Inc.
  - The G-S Company
  - Hoosier Fence Co., Inc.
  - Indiana Wire Products, Inc.
  
  - Kentucky Metal Products Co.
  - King Wire Partitions Inc.
  - Lakeside Wire and Iron Co.

Miller wire Works, Inc.  
Wire and Iron Products, Inc.

## 2.2 HEAVY DUTY MESH PARTITIONS

- A. Mesh: 10-gage crimped steel wire woven into 1-1/2-inch diamond mesh, securely clinched to frame members.
- B. Frames: Provide cutouts for pipes, ducts, beams, and other items shown or necessary for partition installation. Finish edges of cutouts to provide a neat, protective edge.
- C. Frame Members: Cold rolled steel channels, conforming to ASTM A36, with bolt holes approximately 18 inches o.c.
  - 1. Horizontal Reinforcing Members: Cold rolled steel channel with wire woven through, or two channels bolted or riveted toe-to-toe through the mesh and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer.
- D. Stiffening Bars: Provide flat bar stiffener posts between all abutting panel frames. Size as recommended by partition manufacturer for partition height required. Increase size of stiffening bars if required to maintain partition rigidity.
- E. Top Capping Bars: Channel secured to top framing members with 1/4 inch "U" bolts spaced not more than 28 inches o.c.
- F. Corner Posts: Angles with floor shoe and 3/8 inch bolt holes to align with bolt holes in vertical frame members.
- G. Line Posts: Where partition runs exceed 20 feet without intersection or connection to overhead framing, furnish 3 inch by 4.1 pound channel line posts with 5 inch by 18 inch by 1/4 inch base plates located at recommended intervals to ensure partition rigidity and stability.
- H. Intersection Posts: Wherever 3- or 4-way intersections occur, use tubular steel post with floor shoe and 3/8 inch bolt holes aligned for bolting to adjacent panels.
  - 1. For other than 90 degree intersections, use manufacturer's recommended tubular corner posts and installation accessories.
- I. Floor Shoes: Cast metal, sized to suit vertical framing and to provide clear space between finished floor and

bottom horizontal frame members as indicated on drawing.  
Furnish units with set screw for leveling adjustment.

## 2.3 DOORS

- A. Hinged Door: Door frame of 1-1/2" x 3/4" channel with 1-1/2 x 1/8" flat bar cover three sides. 1-5/8" x 7/8" x 1/8" angle riveted to lock side. Each door shall have 1-1/2 pairs heavy butt hinges riveted to both door and hing bar. Mortise type cylinder locks operated by key outside, recessed knob inside.
- B. Provide (2) 120 Lengths of Steel 80 dia. Chain per cage door as shown on plans.

## 2.4 FABRICATION

- A. Do not use components less than sizes indicated. Use larger size components as recommended by partition component manufacturer.
- B. Provide bolts, hardware, and accessories for complete installation.
- C. Finish: Manufacturer's standard shop-applied enamel finish. Provide manufacturer's standard finish color.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

### 3.2 INSTALLATION

- A. Erect partitions plumb, rigid, properly aligned, and securely fastened in place, complying with drawings and manufacturer's recommendations.
- B. Provide additional field bracing as shown or necessary for rigid, secure installation. Erector to provide additional clips and bracing as required.

- C. Installation: All bolts shall be welded or peened to eliminate removal of nuts.

### 3.3 ADJUST AND CLEAN

- A. Adjust moving components for smooth operation without binding.
- B. Touch-up damaged finish after completion of installation using field-applied paint to match color of shop-applied finish.

END OF SECTION





## SECTION 10651

### OPERABLE PANEL PARTITIONS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Folding panel acoustic partition.
- B. Ceiling track and operating hardware.
- C. Manual operation.

##### 1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Recess for floor track.
- B. Section 05500 - Metal Fabrication: Overhead track structural support framing.
- C. Section 06114 - Wood Blocking and Curbing: Wood blocking and track support shimming.
- D. Section 06200 - Finish Carpentry: Wood perimeter trim.
- E. Section 07213 - Batt Insulation: Acoustic barrier placed between top of partition track and roof deck above.
- F. Section 09511 - Suspended Acoustical Ceiling: Adjacent ceiling finish.
- G. Section 09260 - Gypsum Board System: Door pocket construction.
- H. Section 09900 - Painting: Field applied paint finish to panels.

##### 1.3 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. ASTM E90 - Airborne-Sound Transmission Loss of Building Partitions.
- C. ASTM E413 - Classification for Rating Sound Insulation.

- D. ASTM E557 - Architectural Application and Installation of Operable Partitions.
- E. ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
- F. NEMA LD-3 - High Pressure Decorative Laminates.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Sound Transmission Coefficient (STC): 48-52 measured in accordance with ASTM E90, tested on panel size of 100 sq ft (9.3 sq m).
- B. Surface Burning of Plastic Laminate Finish: ASTM E84; flame/smoke rating of 25/50.
- C. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- D. Operation: Center opening; continuous hinged panels; center stacking.

#### 1.5 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking sizes.
- B. Product Data: Provide data on partition operation, hardware and accessories, colors and finishes available.
- C. Samples:
  - 1. Submit two samples of full manufacturer's color range for selection of colors.
  - 2. Submit two samples of surface finish, 12 x 12 inches (300 x 300 mm) size, illustrating quality, colors selected, texture, and weight.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and installation sequence.
- E. Manufacturer's Certificate: Certify that partition system meets or exceeds specified acoustic requirements.

## 1.6 MAINTENANCE DATA

- A. Include recommended cleaning methods, cleaning materials, and stain removal methods.
- B. Describe cleaning materials detrimental to surfaces and hardware finish.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum six years documented experience. approved by manufacturer.

## 1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.9 COORDINATION

- A. Coordinate the work with other sections providing panel finish materials to this section.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Acceptable manufacturers offering equivalent products.
  - 1. Foldoor/Holcomb & Hoke Mfg Co., 1545 Van Buren St.  
P. O. Box A - 33900, Indianapolis, Indiana 46203  
317-784-2444.
  - 2. Hufcor/AirWall, 8140 East Rosecrane Avenue,  
Paramount, CA 90723  
800-356-6968
  - 3. Modernfold, Inc., 1711 I Avenue  
New Castle, IN 47362  
317-529-1450

## 2.2 COMPONENTS

- A. Panel Construction:
  - 1. Panel Substrate Facing: Steel sheet, 20 gage thick.

2. Core: Gypsum board and mineral wool construction utilizing manufacturer's standard fabrication methods.
  3. Thickness Without Finish: 3 inches.
  4. Trim: Trimless.
  5. Hinges: butt type, stainless steel.
  6. Panel to Panel Seals: Grooved and gasketed astragals; continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
- B. Track: Formed steel 1-5/8 x 1-5/8 inches size; thickness and profile designed to support loads.
- C. Carriers: Ball bearing, steel wheels on trolley carrier at top of every panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- D. Hardware: Latching door handles of satin chrome finish; pull bars.
- E. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.
- F. Accessories: White enamelled ceiling closure] aluminum jamb and head molding, fittings and attachments, and intermediate meeting posts.
- G. Acoustic Sealant: Manufacturer's standard.

## 2.3 PANEL FINISHES

- A. AFoldoor/Holcomb AAcoustical fabric Hytexrib color: Mist 19-04
- B. Shop apply surface finish to operable panel partitions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify track supports are laterally braced and will permit track to be level within 1/4 inch (6 mm) of required position and parallel to the floor surface.
- B. Verify floor flatness of 1/8 in 10 feet (3 mm / 3 m), non-cumulative.

- C. Verify wall plumbness of 1/8 in 10 feet (3 mm / 3 m), non-cumulative.

### 3.2 INSTALLATION

- A. Install partition in accordance with manufacturer's instructions.
- B. Fit and align partition assembly and pocket doors level and plumb.
- C. Lubricate moving components.
- D. Apply acoustic sealant to achieve required acoustic performance.

### 3.3 ADJUSTING

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust to achieve light tight seal.

### 3.4 CLEANING

- A. Clean finish surfaces and partition accessories.

### 3.5 DEMONSTRATION

- A. Demonstrate operation of partition, identify potential operational problems, and provide Government with instruction manuals.

END OF SECTION



SECTION 10753

WALL-MOUNTED TELEPHONE ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall-mounted telephone enclosures.

1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board System.
- B. Section 09900 - Painting.

1.3 REFERENCES

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 603.8 Voluntary Performance Requirements and Test  
Procedures for Pigmented Organic Coatings on  
Extruded Aluminum

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A117.1 Specifications for Making Buildings and Facilities  
Accessible to and Useable by Physically Handicapped  
People

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 Standard Specification for Stainless and Heat-  
Resisting Chromium-Nickle Steel Plate, Sheet, and  
Strip

ASTM A 366 Specification for Steel, Carbon, Cold-Rolled Sheet,  
Commercial Quality

ASTM A 525 Specification for General Requirements for Steel  
Sheet, Zinc-Coated (Galvanized) by the Hot-Dip  
Process

ASTM A 526 Specification for Steel Sheet, Zinc-Coated  
(Galvanized) by the Hot-Dip Process, Commercial  
Quality

ASTM A 568 Specification for General Requirements for Steel,  
Carbon and High-Strength Low-Alloy Hot-Rolled Sheet  
and Cold Rolled Sheet

- ASTM B 209    Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- ASTM B 221    Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
- ASTM C 1048   Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass
- ASTM D 790    Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- ASTM D 1003   Test Method for Haze and Luminous Transmittance of Transparent Plastics

#### NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

- NEMA LD 3    High Pressure Decorative Laminates

#### 1.4    SUBMITTALS:    Submit under provisions of Division 1.

- A.    Shop Drawings:    Indicate location and anchorage detail of telephone enclosures to wall construction.
- B.    Product Data:    Provide construction data on telephone enclosures.

#### 1.5    QUALIFICATIONS

- A.    Manufacturer:    Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

#### 1.6    FIELD MEASUREMENTS

- A.    Verify that field measurements are as indicated on shop drawings.

### PART 2    PRODUCTS

#### 2.1    MANUFACTURERS

- A.    Acceptable manufacturers offering equivalent products.
  - 1.    American Specialties, Inc. - Product:    Tellette 1310-SH
  - 2.    Phillip & Brooks, Inc. - Product:    PB-101/Indoor Enclosure
  - 3.    Redy Ref Pressed & Welded, Inc. - Product:    MS 2200-CF



## 2.2 MATERIALS

- A. Stainless steel plate, sheet and strip: Provide stainless steel plate, sheet, or strip, A151 type 302 or 304. Comply with requirement of ASTM A 167.
  - 1. Perforated panels: Provide panels with not less than 1000 perforations per square foot for acoustical panels.
  - 2. Acoustical Material: Provide non-flaking or enamel glass fiber sound absorption blankets or boards.

## 2.3 WALL-MOUNTED, SHELF TYPE TELEPHONE ENCLOSURES

- A. General: Provide wall mounted, shelf type telephone enclosure units of the style indicated.
  - 1. Provide groupings of enclosures with a common divider wall between adjacent units.
- B. Enclosure Body: Provide surface-mounted, shelf-type telephone enclosures of the size and style indicated. Enclosures shall consist of an acoustic rear wall panel containing the telephone instrument, side walls, and a writing shelf.
  - 1. Side Walls: Stainless steel acoustic panels.
  - 2. Shelf: Full-length stainless steel writing shelf.

## 2.4 ACCESSORIES

- A. Telephone Type: Bell Type 1 standard box-type, coin-operated telephone instrument.
- B. Inserts and Anchorages: furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Coordinate delivery of inserts and anchoring devices with other work to avoid delaying installation.
- C. Fasteners: provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Fasteners for application on the exterior and exposed to the weather may be hot-dip galvanized, stainless steel, or aluminum. Provide types, gages, and lengths to suit installation conditions. Use theft-proof fasteners where exposed to view.

## 2.5 FABRICATION

- A. Construction: Fabricate telephone enclosures to requirements indicated. Provide units square, rigid, and without warp, with metal edges flat and free of dents or distortion. Make exposed metal edges safe to touch. Weld members together to form a rigid one-piece structure. Grind exposed welds flush.
- B. Shop Assembly: Preassemble telephone enclosures in the shop to the greatest extent possible, to minimize assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

## 2.6 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
  - 1. Stainless Steel Finishes: Finish designations prefixed by "AISI" conform to the system established by the American Iron and Steel Institute for designating finishes.
    - a. Bright, Directional Polish Finish: AISI Type 302 or 304 with No. 4 directional polish finish.
      - 1) Grain Direction: Horizontal

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install telephone enclosures and related accessories at locations shown in accordance with manufacturer's instructions. Provide clips, grounds, backing materials, brackets and anchors, trim and accessories necessary for a complete installation.

### 3.2 ADJUST AND CLEAN

- A. Replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended by the manufacturer.

END OF SECTION

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet, bath shower and washroom accessories.
- B. Grab bars.
- C. Attachment hardware.

1.2 RELATED SECTION

- A. Section 09111 - Metal Stud Framing System: In wall framing and plates for support of accessories.
- B. Section 10160 - Metal Toilet Compartments.

1.3 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- G. NEMA LD-3 - High Pressure Decorative Laminates.

1.4 SUBMITTALS: Submit under provisions of Division 1.

- A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- B. Samples: Submit two samples of each component, illustrating color and finish.

- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and anchorage.

#### 1.5 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code for access for the handicapped.

#### 1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on product data.

#### 1.7 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc. Product Bobrick
- B. Bradley Corporation Product Bradley
- C. American Specialties

#### 2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Adhesive: Two component epoxy type waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and security type.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

#### 2.3 FABRICATION

- A. Weld and grind joints of fabricated components, smooth.

- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1.5 inches (38 mm) clear of wall surface.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

#### 2.4 KEYING

- A. Supply 4 keys for each accessory to Owner.
- B. Master key all accessories.

#### 2.5 FINISHES

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd (380 g/sq m). Galvanize ferrous metal and fastening devices.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Stainless Steel: No. 4 satin luster finish.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify exact location of accessories for installation.

#### 3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.

### 3.4 SCHEDULE

- A. AC-1, Mop and Broom Holder, (ASI Model 1318, Bradley Model 9986 Bobrick Model B-224) - Strip shall be constructed of 16 gauge Type 302 (18-8) stainless steel no. 4 satin finish. Strip shall be formed with a return flange to the wall on top and a returned flange to the wall at the bottom. Holder pieces shall be constructed from molded resilient rubber with ribbed gripping surface. Strip shall be 48" long with 6 holders.
- B. AC-4, Lavatory Mounted Detergent, Lotion and Liquid Soap Dispenser (ASI Model 0328, Bradley Model 6322, Bobrick Model B-833). Lavatory Mounted Soap Dispenser shall dispense synthetic detergents, viscous lotion soaps, antiseptic solutions and vegetable oil base liquid soaps. Piston and spout assembly shall be 300 Series stainless steel. Spout shall rotate 360 degrees without damage to valve mechanism. Cover shall lock to body with concealed locking mechanism opened only with special key provided. Piston, spout and supply tube assembly shall be removable from top for top filling and maintenance. Valve shall have ABS cylinder and Buna N O-ring seals and duckbills. Shank shall accommodate mounting thickness up to 4" (102 mm). Translucent, unbreakable polyethylene container shall have a capacity of 32 fl oz (0.94 liter).
- C. AC-5, Recessed Feminine Napkin Disposal (ASI Model 0473, Bradley Model 4731-15, Bobrick Model No. B-353). Recessed Feminine Napkin Disposal shall be constructed entirely of Type 304 stainless steel, welded construction. Exposed surfaces shall have satin finish. Flange shall be drawn, one-piece, seamless construction. It shall have a self-closing door equipped with full length stainless steel piano hinge and a stainless steel receptacle, removable for servicing.
- D. AC-6, Partition Mounted Feminine Napkin Disposal For Servicing Two Toilet Compartments (ASI Model 0472, Bradley Model 4721-15, Bobrick Model B-354). Dual feminine napkin disposal shall be constructed entirely of type 302 stainless steel. Exposed surfaces shall have satin finish.

Flanges shall be drawn, one-piece seamless construction. Unit shall mount in partition and serve two toilet compartments. It shall have two self closing doors equipped with full length piano hinges and a single stainless steel receptacle that can be serviced from one side only. Other side of cabinet shall be built with a permanent panel.

- E. AC-7, Recessed Paper Towel Dispenser and Waste Receptacle (ASI Model 0462 AD, Bradley Model 2291, Bobrick Model No. B-369). Recessed paper towel dispenser and waste receptacle shall be constructed entirely of Type 304 stainless steel, welded construction with exposed surfaces satin finish. Flange shall be drawn one-piece seamless construction. Door shall be double pan construction and equipped with a knob latch. Door shall be secured to cabinet with full-length stainless steel piano hinge. Paper Towel Dispenser shall be capable of dispensing 350 C-fold or 475 Multifold paper towels without use of adapters. Waste receptacle, removable for servicing, with top edges hemmed for safe handling, shall have a capacity of 2 gallons (7.6 liters).
- F. AC-9, Recessed Combination Paper Towel Dispenser and Waste Receptacle For 8" Wall (ASI Model 04697, Bradley Model 237, Bobrick Model B-3900). Recessed Combination Paper Towel Dispenser and Waste Receptacle shall be constructed entirely of type 304 stainless steel, welded construction, with exposed surfaces satin finish. Flange shall be drawn, one-piece seamless construction. Paper towel dispenser shall have door with full-length stainless steel piano hinge and be equipped with tumbler lock. It shall be adaptable to dispense either C-Fold towels (capacity 500), Multifold towels (capacity 800) or Singlefold towels (capacity 1100). Removable waste container shall have a capacity of more than 1.5 cu. ft. and be secured to cabinet with tumbler lock.
- G. AC-11, 1-1/2-inch (38mm) Diameter Stainless Steel Grab Bars With Concealed Mounting (ASI 3201-36, Bradley 812-001-36, Bobrick Model B-6206 x 36" in length). Grab bar shall be constructed of type 304 stainless steel with satin finish. It shall have wall thickness of 18 gauge (1.2 mm) and outside diameter of 1-1/2" (38 mm). Distance from inside of grab bar to finished wall shall be 1-1/2" (38 mm). Flanges shall be 11 gauge (3.2 mm) stainless steel, 3" (76 mm) diameter and each shall have 4 stainless steel set screws. Ends of grab bar shall pass thru flanges and be heliarc welded to form one structural unit. Concealed

mounting plates shall be 13 gauge (2.3 mm) stainless steel with 3 slotted screw holes.

- H. AC-12, 1-1/2 inch Diameter All Stainless Steel Grab Bar (ASI Model 3201-42, Bradley 812-001-42, Bobrick Model B-6206 x 42" in length). Grab bar shall be constructed of type 304 stainless steel with satin finish. It shall have wall thickness of 18 gauge (1.2 mm) and outside diameter of 1-1/2" (38 mm). Distance from inside of grab bar to finished wall shall be 1-1/2" (38 mm). Flanges shall be 11 gauge (3.2 mm) stainless steel, 3" (76 mm) diameter and each shall have 4 stainless steel set screws. Ends of grab bar shall pass thru flanges and be heliarc welded to form one structural unit. Concealed mounting plates shall be 13 gauge (2.3 mm) stainless steel with 3 slotted screw holes.
- I. AC-13, Stainless Steel Utility Hook (ASI Model 7340-S, Bradley Model 9115, Bobrick Model B-670). Utility Hook shall be constructed entirely of type 304 stainless steel.
- J. AC-14, Stainless Steel Toilet Paper Holder (ASI Model 7305-S, Bradley Model 5084, Bobrick Model B-6857). Toilet Paper Holder shall be constructed entirely of type 304 stainless steel with satin finish. Support arm and flange shall be equipped with concealed 16 gauge mounting bracket which locks to concealed stainless steel wall plate with stainless steel set screw. Roller shall be chrome-plated plastic, with heavy duty internal spring.
- K. AC-15, Extra Heavy Duty Shower Curtain Rod With Concealed Mounting (Bobrick Model No. B-207). Shower curtain rod shall be 1" (25mm) outside diameter and constructed of 20 gauge (0.0 mm), type 304, stainless steel with satin finish. Flanges shall be 1-5/8" (41mm) diameter chrome plated brass with polished finish.

NOTE: All grab bar installation shall withstand forces in excess of 300 lbs. All components and installation shall conform with the latest requirements.

END OF SECTION



## SECTION 11132

### REAR PROJECTION SCREENS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Rigid rear projection screens, factory framed.

##### 1.2 Related Sections:

- A. Section 06114 - Wood Blocking and Curbing.
- B. Section 09111 - Metal Stud Framing System.
- C. Section 09260 - Gypsum Board System.

##### 1.3 REFERENCES

###### A. American Architectural Manufacturers Association

1. AAMA 606.1: Voluntary Guide specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. AAMA 607.1-1977: Voluntary Guide Specification and Inspection Methods for Integral Clear Anodic Finishes for Architectural Aluminum.
3. AAMA 608.1-1977: Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

###### B. American Society for Testing and Materials:

1. ASTM B 221-90: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
2. ASTM C 1036-90: specification for Flat Glass.
3. ASTM D 1003-61 (1988): Test Method for Haze and Luminous Transmittance of Transparent Plastics.
4. ASTM D 4802-88: Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

###### C. Federal Specifications:

1. FS GG-S-00172D(1): Screen, Projection.

2. Federal Standard 191A/5760: Mildew Resistance of Textile Materials.
  3. Federal Standard 191A/5903: Flame Resistance of Cloth; Vertical
- D. National Fire Protection Association:
1. NFPA 701-1989: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.
- 1.4 SUBMITTALS: Submit the following under provisions of Division 1.
- A. Product data: screen specified.
  - B. Shop drawings: showing layout and types of projection screens. Show the following:
    1. Location of screen centerline.
    2. Anchorage details.
    3. Accessories.
    4. Frame details for front projection screens.
- 1.5 QUALITY ASSURANCE
- A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.
  - B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through partition.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.
  - B. Protect screens from damage during delivery, handling, storage, and installation.
  - C. Store rear projection screens in manufacturer's protective packages in a position that complies with screen

manufacturer's directions. Keep units in manufacturer's protective packages until time of installation.

- D. Protect surfaces of rear projection screens from damage due to abrasion, dust, and other conditions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Da-Lite Screen Co., Inc. Product: Mark 30 (800) 622-3737.
- B. Draper Shade & Screen Co., Inc. Product: Diamond Screen (317) 987-7999.
- C. Stewart Filmscreen Corp. Product: Opta Screen (800) 762-4999.

### 2.2 RIGID REAR PROJECTION SCREENS

- A. General: Provide manufacturer's standard rear projection screen materials complying with requirements indicated for materials and fabrication.
- B. Screen Substrate: Optically clear substrate complying with the following requirements:
  - 1. Colorless transparent cast acrylic sheet with a light transmittance of 92 percent per ASTM D 1003 and complying with ASTM D 4802 for Cast Category C-1 materials, in the following nominal thickness:
    - a. Thickness: 1/4 inch (6.40 mm).
- C. Optical Coating: Durable, washable emulsive formulation deposited on one side of substrate, designed and applied to bond firmly and continuously to glass and plastic substrates with the following characteristics:
  - 1. Color and Gain: Neutral grey with nominal gain of 5.0 at a viewing angle of 0 horizontal degrees off screen axis.
  - 2. Coating Thickness: 0.009 inch.
- D. Protective Coating: Formulation designed by screen manufacturer as a permanent topcoat over 0.004-inch-thick optical coatings to protect against normal abrasion before, during, and after installation.
- E. Size of Viewing Surface: Nominal diagonal: 72", Image Size: 43-1/4" x 57 5/8", Overall Size: 44-1/4" x 58-5/8".

- F. Factory Frames: Screen manufacturer's standard frames of profile indicated, fabricated to sizes required to fit screens from aluminum extrusions of alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.
  - 1. Class I Color Anodized Finish: AA-M12C22A42/A44  
Mechanical Finish: as fabricated, nonspecular;  
Chemical Finish: etched, medium matte; Anodic  
Coating: Class I Architectural, film thicker than 0.7 mil with integral color or electrolytically deposited color) complying with AAMA 606.1 or AAMA 608.1.
    - a. Color: As selected by Architect from within standard industry colors and color density range.
- G. Rear project screen shall be installed using one of the following systems:
  - 1. "Deluxe Frame" by Da-Lite.
  - 2. "Cineframe System 300" by Draper.
  - 3. "Perimeter 2000 Series by Stewart".

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.
- B. Install factory-framed rear projection screens in prepared wall openings. Securely anchor frames to surrounding construction so that frames are plumb and level, screen surfaces are flat, and optically coated surfaces are oriented as follows:
  - 1. Place optically coated surface toward projector.

### 3.2 PROTECTION AND CLEANING

- A. Protect projection screens after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.
  - 1. Provide temporary covering of rear projection screens until time of Substantial Completion. Use type of

covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

- B. Wash rear projection screens on both faces immediately prior to date scheduled for inspection intended to establish date of Substantial Completion. Use methods and cleaning materials recommended by screen manufacturer, taking care not to scratch or damage optical coatings or screen substrates in any way.

END OF SECTION



## SECTION 11133

### PROJECTION SCREENS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Projection screens, factory framed.

##### 1.2 Related Sections:

- A. Section 06114 - Wood Blocking and Curbing.
- B. Section 09111 - Metal Stud Framing System.
- C. Section 09260 - Gypsum Board System.

##### 1.3 REFERENCES

###### A. American Architectural Manufacturers Association

1. AAMA 606.1: Voluntary Guide specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. AAMA 607.1-1977: Voluntary Guide Specification and Inspection Methods for Integral Clear Anodic Finishes for Architectural Aluminum.
3. AAMA 608.1-1977: Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

###### B. American Society for Testing and Materials:

1. ASTM B 221-90: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
2. ASTM C 1036-90: specification for Flat Glass.
3. ASTM D 1003-61 (1988): Test Method for Haze and Luminous Transmittance of Transparent Plastics.
4. ASTM D 4802-88: Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.

###### C. Federal Specifications:

1. FS GG-S-00172D(1): Screen, Projection.

2. Federal Standard 191A/5760: Mildew Resistance of Textile Materials.
  3. Federal Standard 191A/5903: Flame Resistance of Cloth; Vertical
- D. National Fire Protection Association:
1. NFPA 701-1989: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.
- 1.4 SUBMITTALS: Submit the following under provisions of Division 1.
- A. Product data: screen specified.
  - B. Shop drawings: showing layout and types of projection screens. Show the following:
    1. Location of screen centerline.
    2. Anchorage details.
    3. Accessories.
    4. Frame details for front projection screens.
- 1.5 QUALITY ASSURANCE
- A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.
  - B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through partition.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.
  - B. Protect screens from damage during delivery, handling, storage, and installation.
  - C. Store rear projection screens in manufacturer's protective packages in a position that complies with screen



manufacturer's directions. Keep units in manufacturer's protective packages until time of installation.

- D. Protect surfaces of rear projection screens from damage due to abrasion, dust, and other conditions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Da-Lite Screen Co., Inc. Product: Mark 30 (800) 622-3737.
- B. Draper Shade & Screen Co., Inc. Product: Diamond Screen (317) 987-7999.
- C. Stewart Filmscreen Corp. Product: Opta Screen (800) 762-4999.

### 2.2 PROJECTION SCREEN SURFACES, GENERAL

- A. Measurement of Gain of Screen Viewing Surface: Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172D(1) for determining effect of reflected light at various viewing angles on screen surfaces. Ratings of 1.0 refer to those viewing surfaces having a reflectivity equal to the magnesium carbonate surface.
- B. Material and Viewing Surface of Front Projection Screens: Obtain screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:
  - 1. Matte white viewing surface with minimum gain characteristics complying with FS GG-S-00172D(1) for Type A screen surface.
    - a. Application: Provide matte white surfaces unless otherwise indicated.
    - b. Edge Treatment: Without black masking borders.
  - 2. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by Federal Standard 191A/5760.
  - 3. Fire Performance Characteristics: Provide projection screen fabrics identical to those materials that have undergone testing and passed requirements for flame resistance as indicated below:

- a. NFPA 701 per small-scale test.
- b. Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.

## 2.3 ELECTRICALLY OPERATED FRONT PROJECTION SCREENS

- A. General: Provide manufacturer's standard UL-listed and UL-marked units consisting of case, screen, motor, controls, mounting accessories, and other components required for a complete installation and to comply with requirements indicated for screen surface and controls and for case, motor, and screen under description of operation and type. Remotely control operation of each screen to comply with the following:
  - 1. Single Station Control: Three-position, UL-listed control switch for each screen with metal device box and cover plate for flush wall mounting and for connection to 120 V a.c. power supply.
- B. End-Mounted-Motor-Operated Screens with Automatic Ceiling Closure: Units designed and fabricated for recessed installation in ceiling with bottom of case composed of two panels fully enclosing screen and motor, one panel hinged and connected to drive mechanism to open and close automatically when screen is lowered and fully raised and the other panel removable or openable for access to interior of case; and complying with the following requirements:
  - 1. Screen Case: Wood sides and top with metal-lined motor compartment and wood or aluminum bottom panels, factory-primed and constructed as follows:
    - a. Offset mount bottom panels to case in position where their bottom surfaces will align flush with finished surface of adjoining ceiling and the bottom edges of case surrounding panels will be recessed by the depth of, and concealed behind, overlapping ceiling finish.
  - 2. Screen: As indicated below, with top edge mounted on, and securely anchored to, rigid metal roller supported by self-aligning bearings in brackets.
    - a. Material: Vinyl-coated glass fiber fabric.
    - b. Size of Viewing Surface: As indicated.
- C. Motor-In-Roller-Operated Screens with Automatic Ceiling Closure: Units designed and fabricated for recessed

installation in ceiling with bottom of case composed of two panels fully enclosing screen and wiring compartments, one panel hinged and activated by operation of screen to open and close automatically when screen is lowered and fully raised and the other panel removable or openable for access to interior of case; and complying with the following requirements:

1. Screen Case: Metal sides and top for both screen and wiring compartment and metal bottom panel, factory-primed and constructed as follows:
  - a. Offset mount bottom panels to case in position where their bottom surfaces will align flush with finished surface of adjoining ceiling and the bottom edges of case surrounding panels will be recessed by the depth of, and concealed behind, overlapping ceiling finish.
2. Motor: Instant reversing motor of size and capacity recommended by screen manufacturer with permanently lubricated ball bearings, automatic thermal overload protection, preset limit switches to automatically stop screen in "up" and "down" positions, and positive stop action to prevent coasting. Mount motor inside roller with vibration insulators to reduce noise transmission.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.
- B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.
  1. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

### 3.2 PROTECTION AND CLEANING

- A. Protect projection screens after installation from damage during construction. If despite such protection damage

occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION

SECTION 11165

DOCK BUMPERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Dock bumpers of reinforced rubber with attachment frame.

1.2 RELATED SECTIONS

- A. Section 05500 - Metal Fabrication: Steel angle cast into concrete dock edge.
- B. Section 09900 - Painting: Field painting of exposed steel frame.

1.3 SUBMITTALS: Division 1 - Submittals: Procedures for submittals.

- A. Product Data: Indicate unit dimensions, method of anchorage, and details of construction.
- B. Manufacturer's Installation Instructions: Indicate special installation requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Durable Corporation, Model B406-24.
- B. Pawling Corporation, Model H1026.
- C. Pioneer Manufacturing, Inc.

2.2 COMPONENTS

- A. Bumpers: Fabric reinforced rubber pads, ozone resistant, laminated and compressed in position with two galvanized steel rods with threaded ends, washers and nuts; between 3 x 2-1/2 x 1/4 inch (75 x 60 x 6 mm) galvanized steel angle end plates:

- 1. Projection From Wall: 4 1/2 6 inches (115 mm).
- 2. Vertical Height: 10 inches (250 mm).
- 3. Length: 24 inches (600 mm).

B. Attachment Hardware: 3/4 inch (19 mm) diameter galvanized bolts and expansion shields.

C. Touch-up Primer: Zinc rich type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that anchor placement is acceptable.

3.2 PREPARATION

A. Provide integral anchors for placement by Section 03300.

3.3 INSTALLATION

A. Install dock bumpers in accordance with manufacturer's instructions.

B. Set plumb and level.

C. Secure angle end frames to concrete.

END OF SECTION

SECTION 11400  
DARKROOM EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Stainless Steel Sink, Countertop, ~~and Base Cabinet.~~ |
- B. Connection to utilities.

1.2 RELATED SECTIONS

- A. Mechanical supply and hook-up to equipment: DIVISION 15.

1.3 SUBMITTALS: Make submittals in accordance with Division 1.

- A. Shop Drawings: Submit minimum 3/4 inch scale shop drawings minimum 1-1/2 inch scale sections) of custom fabricated items showing construction methods, type and gage of metal, hardware and fittings, with plan, front elevation and a minimum of one cross-section. Show complicated parts of typical item in a cut-away perspective.
- B. Rough-In Drawing: Submit rough-in drawings for manufactured kitchen equipment showing dimensioned locations, size and heights.
- C. Manufacturer's Data: Submit the manufacturer's product data for manufactured equipment showing service connections, characteristic, and wiring diagrams for control systems.

1.4 STANDARDS

- A. Perform work and provide materials in accordance with the following jurisdictions but not limited to:
  - 1. U.S. Public Health Service
  - 2. National Sanitation Foundation - seals affixed
  - 3. National Board of Fire Underwriters
  - 4. Local or State Ordinances
  - 5. State Accident Commission's Safety Order

6. State Fire Marshal

7. A.D.A. Regulations

8. U.L. Listings

#### 1.5 OPERATION AND MAINTENANCE DATA

- A. At completion of the work, provide a qualified and trained manufacturer's representative to demonstrate the operation of each item of equipment and instruct the Owner in the operating procedure and maintenance.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Have finished components and assemblies wrapped and crated at the factory in a manner to prevent damage or marring or assemblies or surfaces during shipping and handling.
- B. Deliver materials to the site, unload and store. Lay panels and flat sections flat and blocked clear of floor in a manner to prevent warping, or sagging.
- C. Coordinate size of access and route to place of installation.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Before moving equipment in, ensure that surrounding finishes {floors, walls, ceilings and painting} are completed.
- B. Maintain room temperature of at 65 degrees Fahrenheit for 72 hours before equipment installation begins, and continuous during and after installation.

#### 1.8 POWER CHARACTERISTICS

- A. As indicated on the Drawings or Schedules.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT MANUFACTURER'S

- A. Manufacturer's: As specified in this section.
- B. Substitutions: Items of the same function and



performance will be considered. Ten days prior approval to reception of bids required.

## 2.2 CUSTOM FABRICATED ITEM MATERIALS

- A. Stainless steel: ASTM A 264 Type 304 grade, thickness as indicated, No. 4 finish.

## 2.3 CUSTOM ITEM FABRICATION

- A. Ensure that gages of metal, fabrication and reinforcement are adequate for the various conditions and to accepted industry standards. Tube sizes noted are outside diameter.
- B. Stainless steel fastenings and fittings: Type 304. Supply bolts, wood screws and metal screws with counter sunk flat heads at interior and exterior visible or accessible surfaces. Use concealed fastenings to the greatest extent possible.
- C. Form edges smooth. Fabricate sheet material for counter tops, facing, shelves and drainboards of straight lengths in one continuous sheet where practical.
- D. Provide cutting and patching of items of this section required for the proper installation of other services.
- E. Weld parts to be non-porous, free from imperfections, pits, cracks and discoloration. Grind welds in stainless steel to be smooth and flush and polish to match adjacent sheet material finish. Use heli-arc welding for stainless steel.
- F. Where manufacturing process disturbs the original finish, carefully regrind, polish and restore to match the original undisturbed surfaces.
- G. Provide trim to create sanitary conditions and finished appearance.
- H. Do not use measurements indicated on the Drawings for fabricating equipment.
- I. Sound Deadening: Sound deaden undersides of metal table tops, bottom of drawers and shelves, and inside of doors with high quality asphalt mastic. Sound deadening material is not required in insulated doors.

J. Table and Counter Tops: 14 ga. stainless steel with horizontal and vertical corners coved on 1/4 inch radius.

1. Reinforcement: 1-1/2 X 1-1/2 x 1/8 inch galvanized steel angles. Reinforce tops of base fixtures and tables so that there will be no noticeable deflection with underneath framework as follows:
  - A. Provide cross angle member under tops, at intervals of not less than 15 inches, or more than 18 inches.
  - B. Provide one angle runner, running lengthwise down center of tops up to 30 inches wide. Provide two angle runners running lengthwise down tops over 30 inches wide.
  - C. Stud weld reinforcement to the undersides of the tops.
2. Finish: Grind welded seams and corners smooth, and polish. Do not rivet or bolt through tops.
3. Mount tops on open type frame.

K. ~~[Deleted]Base partitions and cabinet bodies: 18 ga. stainless steel.~~

- ~~1. Reinforcement: Reinforce body with channels and gussets where necessary.~~
- ~~2. Corners: Round free corners of enclosed bodies on 5/8 inch radius. Make corners against walls and other fixtures square.~~
- ~~3. Trim: Stainless steel.~~
- ~~4. Toe Board: 4 inch high stainless steel reinforced with channel braces.~~

L. Sinks and sink partitions: round cornered, 14 ga. stainless steel, fully polished inside and out with bottom sloping 1/2 inch to drain. Form from one continuous sheet with ends welded in place.

1. Vertical and Horizontal Corners: Cover on 5/8 1 inch radius

2. Top Edges: Except where fitted with integral type drainboards, form front and ends, with a 1-1/2 inch die formed, integral, sanitary, semi-roll rim.
3. Splashback: Unless otherwise specified, provide 10 inch splashback with a 2 inch wide return, turned back at 45", across the back of base cabinet. Enclose ends of splashbacks. Provide two faucet holes on 8 inch centers over the center line of partitions between compartments, on splashback.
4. Sink Bottoms: Die stamp bottom of each compartment with 4 radial grooves and provide lever handle drain and tail piece.
5. Mount sink bodies on open frames. Fit legs with die formed fully enclosed gussets, welded to the underside of the sink reinforcement framing. Fabricate so that sinks are 36 inches high at the front edge, unless otherwise indicated.
6. Drainboards: Same material as sinks, integrally welded to sink units. Die form 1-1/2 inch high rims with integral rolled edge to match sink edges provided splashbacks to match sink splashback. Cove horizontal and vertical corners on 5/8 inch radius, heli-arc weld, grind and polish to match original finish. Do not solder fillet corners. Pitch drainboards to drain into sink. Weld splashback integrally with splashback of sink compartment and enclosure ends.
7. Brace multiple compartment longitudinally in the center with a 12 ga. stainless steel channel with filled ends.

M. ~~[Deleted] Drawers:~~

- ~~1. Bodies: Die stamped out of one piece of 18 ga. stainless steel. Flange top edges of drawers out 1/2 inch. Round interior horizontal corners on a 1 inch radius and interior vertical corners on a 2 inch radius. Do not use solder or other material to fillet corners.~~
- ~~2. Faces: 16 ga. stainless steel. Die stamp faces with a raised border for rigidity, and emboss integral handle in face.~~

- ~~3. Rivet channel drawer slides with steel ball bearing rollers to body of drawer and weld to back of drawer faces. Provide adjustable stops on each drawer.~~
- ~~4. Partially enclose drawers on open base tables between channel slides on underside of top with 18 gauge stainless steel~~
- ~~5. Drawer size to be width as shown on drawings by 20" long by 5" deep - 18 gauge stainless steel drawer insert to be easily removed without tools.~~

N. — [Deleted]Interior Shelves:

- ~~1. Solid shelving: 16 ga. stainless steel with ends and backs turned up 1 1/2 inches and welded to cabinet walls, turn front edges down 1 1/2 inches and turn under 1/2 inch.~~
- ~~2. Reinforcement: Rigidly reinforce shelves with angle or channel framework below to prevent sagging.~~
- ~~3. Where shelves must abut chases, turn abutting edges up a minimum of 3 inches.~~

O. — [Deleted]Wall Mounted Shelves:

- ~~1. Material: 16 gauge stainless steel.~~
- ~~2. Size: 12 inches wide x length of table over which shelf is mounted.~~
- ~~3. Front Edges: Roll on a 1/2 inch radius.~~
- ~~4. Ends: Turn down vertically.~~
- ~~5. Back Edges: Turn up vertically 1 1/2 inches.~~

P. Pipe Chases: Where enclosed base tables require piping to be passed through the base, enclose piping in a suitable pipe chase. Where access to pipes will be through fronts of cabinets, provide easily removable access panels. Form stainless steel access panels in a pan shape, removable without tools. Pipe chases at end of fixtures containing bottom and intermediate shelves need not be enclosed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to equipment installation, verify all utility service connections, and instruction to all parties with regard to shop drawings.

### 3.2 FIELD DIMENSIONS

- A. Before installation, check building dimensions and service rough-in, including means of access, for conditions affecting delivery and installation of equipment.
- B. Carefully measure the locations of all existing conditions, and indicate them and provide for them on shop drawings and project record documents.

### 3.3 INSTALLATION

- A. Where joints in stainless steel work are necessary due to limitations of sheet sized or installation requirements, make tight without open seams by welding.
- B. Close ends of all fixtures, splash aprons, shelves, and bases by sealing or welding end plates.
- C. Indicate exact sizes and locations of blocking required on shop drawings.
- D. Provide inserts, and anchors built into other work for support of this work. Ensure that these items are installed in there proper location. Include fastening devices required to attach the work. Use proper anchoring devices for the materials encountered and the usage expected.
- E. Mount wall brackets on walls with steel masonry inserts and stainless steel machine screws.
- F. Install items in accordance with the manufacturers' instructions using workers skilled and familiar with items and installation requirements.
- G. Shop assemble work where possible, and test at shop.
- H. Insulate to prevent electrolysis between dissimilar metals.

- I. Scribe to walls and columns, set level and rigid, align adjoining pieces of equipment, apply matching filler pieces where equipment abuts walls, columns and is to be closed off.
- K. Do cutting, fitting and patching necessary, coordinating work fully with other trades.
- L. Cut and drill tops, backs, and other elements as required for service outlets and fixtures. Install fixtures and fittings supplied under this section. Have connections to services made by appropriate trades under Divisions 15 and 16.
- M. Seal joint where required using bacteria and water resistant sealant.

### 3.5 ADJUSTING AND CLEANING

- A. Test, clean and adjust equipment and apparatus to ensure proper working order conditions.
- B. Remove masking/protection from stainless steel and other finished surfaces. Thoroughly wash and clean equipment. Polish hardware, accessories, fixtures, and fittings.

END OF SECTION

## SECTION 11470

### DARKROOM EQUIPMENT

#### PART 1 GENERAL

##### 1.1 CONDITIONS

- A. Requirements of the Conditions of the Contract and Supplementary Conditions apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equal", except that the burden is upon the bidder to prove such equality.

##### 1.2 DESCRIPTION

- A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this section.
- B. The work described in this section of the specifications includes, but is not limited to, the following:
  - 1. Manufacturing, fabricating and installing all darkroom equipment detailed on the drawings and herein specified. Unless specifically indicated otherwise, all darkroom equipment numbers indicated on the drawings or listed, are manufactured and supplied by Kreonite, Inc., 715 E. 10th Street, Wichita, Kansas 67201.
  - 2. All counter tops associated with darkroom equipment and specified in this section.
  - 3. All cabinets and/or stands for the support of sink units shall be factory pre-finished as herein specified.
  - 4. ~~[Deleted] All sink units, including sinks, washers, processors, tanks, trays and other special glass fiber units as herein specified.~~

5. Cut-outs in this work for all sinks, fixtures, viewlights and drop easels.
6. Installation of above, excluding field connection of water, waste and electrical services.

### 1.3 WORK BY OTHERS

- A. General millwork and wood trim items.
- B. Furnish and install all necessary concealed ground and anchors for attaching darkroom equipment.
- C. Furnish, install and connect all required water services.
- D. Furnish, install and connect all required vents, revents and waste services.
- E. Furnish, install and connect all required electrical service.
- F. All plumbing and electrical services and connections shall comply with all applicable codes even though not specifically called for in these specifications and/or shown on plans.
- G. Where wet connections are made between dissimilar metals, dielectric fittings shall be used to prevent electrolysis.
- H. Rubber, vinyl or other finishes bases, except as specifically noted.
- I. Wall covering.

### 1.4 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
  1. Finishes, Division 9.
  2. Plumbing, Division 15.
  3. Electrical, Division 16.



## 1.5 TESTING

- A. All cabinets shall satisfy the following structural test and be certified by a registered engineer or certified testing laboratory.
- B. Structural test: A wall hung cabinet 36" w x 30" h x 13" d with two (2) horizontal shelves shall be mounted to a stud wall 16" on center covered with 5/8" gypsum board with three (3) No. 10 screws anchored 3" down from the inside of top member and three (3) No. 10 screws anchored 3" up from the bottom of the cabinet directly into the studs. The cabinet shall be loaded to a total weight of 1,200 pounds at the same time a cable bridle shall be attached to the side corners and a horizontal load of 600 pounds exerted to pull cabinet away from the wall. There shall be no signs of stress or failure to the cabinet. A shelf 34 1/2 " long by 12" deep shall be supported at each end and loaded to 400 pounds without failure.
- C. Drawer test: A drawer with a minimum size of 24" x 4" x 22" shall be loaded uniformly with 75 pounds of live load. Operate drawer through 50,000 cycles by opening drawer two-thirds of its travel distance and returning it to closed position, at a rate of 20 cycles per minute. Drawer shall remain operable at completion of test. There shall be no failure in any part of the drawer assembly or operating system. Drawer bottom shall not deflect to a position that interferes with drawer operation.

## 1.6 SUBMITTALS

- A. Shop drawings: Submit in accordance with "General Conditions" and "Supplemental General Conditions" showing room floor plans and elevations of darkroom equipment and locations of plumbing and electrical service field connections for guidance of other trades.
- B. Samples: Submit actual samples of high pressure laminates and laminated glass fiber construction included in manufacturer's standard offering. Submit samples of hardware and edging if required.

## 1.7 DARKROOM EQUIPMENT DESIGN CONCEPT

- A. All darkroom equipment in this section shall be furnished by one manufacturer unless specifically noted otherwise. Continuity and uniformity in design shall exist for all units. Units shall be functional and have the aesthetic

essentials required to create pleasant, efficient surroundings and designed to give long life and service.

## PART 2 PRODUCT

### 2.1 DARKROOM CASEWORK DESIGN

- A. Exposed exterior surfaces and semi-exposed surfaces shall be decorative high pressure laminate permanently bonded under pressure to both surfaces of a suitable substrate. Laminate shall have low luster and be chosen from the factory's standard selection.
- B. All exterior and interior surfaces shall be able to be cleaned with soap and water.
- C. All exposed edges shall be self-edged with black PVC edgebanding.
- D. All shelf edges shall be edged with PVC edgebanding, matching shelf color.
- E. All cabinets shall be manufactured with hinged doors, drawers, and face panels factory attached in an overlay design. Doors shall be capable of opening a full 176 degrees. Easy access to adjustable shelves shall be maintained.
- F. All doors, drawers and face panels shall be manufactured with 1/4" reveal and continuously edgebanded. Hinges which require cutting the edge band will not be allowed.
- G. Shelves shall be adjustable on 2 1/2" centers and shall be furnished with shelf clips capable of securing the shelf in a fixed position.
- H. Each base unit assembly shall be supplied with adjustable leveling legs for each four linear feet of base.

### 2.2 ~~[Deleted] SINK UNIT DESIGN~~

- ~~A. All sink units shall be completely finished at the factory. Sink units shall be manufactured of a blend of resins developed especially to resist the corrosive effects of rapid fixes, color bleaches, iron chloride and other chemicals required in photographic and graphic arts processing.~~

- ~~B. Each unit shall be hand lay up molded in one piece from highly polished molds to produce a smooth homogeneous surface.~~
- ~~C. Each unit shall be molded with radius outside and inside corners  
to produce a smooth easily cleaned surface.~~
- ~~D. Sink bottom surface shall be so constructed as to insure positive drainage while supporting processing trays and tanks in a level position.~~
- ~~E. Cure units thoroughly prior to shipment to develop sufficient strength for anticipated load conditions. Remove traces of material which may be toxic or incompatible with other building materials.~~
- ~~F. Each unit shall be factory pre-plumbed to meet specific processing requirements. If heating and/or cooling devices are required, they shall be factory preset to accomplish the required process.~~
- ~~G. Each unit shall be installed on a cabinet or stand of knock-down type construction to facilitate quick assembly and disassembly for installation.~~
- ~~H. Each unit cabinet or stand shall be equipped with four or more adjustable leveling legs as required to properly support and level each individual unit.~~

## 2.3 DARKROOM EQUIPMENT - MATERIALS

### A. CASEWORK MATERIALS

- ~~1. [Deleted]Base cabinet counter tops: Shall be of .042 thick decorative high pressure laminate with self edge, on 1 1/8" solid forty five (45) pound particle board with .020 minimum thick backer sheet on bottom surface.~~
2. Cabinet component parts. Shall be a sandwich of decorative high-pressure laminate permanently pressure pressed to both surfaces of a suitable substrate.
3. Substrate: High grade monolithic particle board or flakeboard with an average of forty-five (45) pounds per cubic foot density and a maximum of 12 percent moisture content.

Properties of Substrate Material:  
Modulus of Rupture PSI 2,700  
Modulus of Elasticity PSI 400,000  
Internal Bond PSI 100  
Dimensional Stability Percent .22  
Screw Holding Strength  
Face Pounds 350  
Edge Pounds 220  
Density Pounds/Cubic Ft. 45  
Thickness Tolerance Inches .005

4. Hardboard: Pre-finished beige color, smooth one side, uniform and free from defects.
5. Edgings: PVC edgebanding, resistant to all normal laboratory reagents, and guaranteed not to craze or crack.
6. Steel parts: Lite-Tile covers and viewlight housings shall be made of steel paintlock sheet, 20 gauge, painted.
7. Drawer Box: Kiln dried hardwood 7/16" nominal thickness.

B. ~~[Deleted]SINK UNIT MATERIALS~~

- ~~1. The work surface shall be polyester resin, Gel Kote, Kreonite type 618EPM.~~
- ~~2. The back up material shall be polyester resin, Kreonite type 9502.~~
- ~~3. The reinforcement shall be glass fiber mat, not less than 40 percent nor more than 60 percent by weight of the completed laminate.~~

C. HARDWARE MATERIALS

1. Hinges: Self-closing, fully concealed, nickel plated with an opening angle of 176 degrees; adjustable for door alignment on frameless box construction.
2. Pulls: Black plastic, 4" long, 1" deep, attached from back of door or drawer.
3. Catches: Not required with self-closing hinges.

4. Shelf support lock: PX Industries, Inc., 50-3/4" or equivalent.
5. Casters: Swivel, minimum 90 pound load capacity, Diameter 3", Width 0.81", or equivalent.
6. Locks: National Lock pin tumbler, cam lock or equivalent.
7. Assembly fitting: Knock down assembly fittings shall be Blum No. 42,070, malleable nylon with die cast cam or equivalent.
8. Drawer Slides: Standard drawers shall be ball bearing type with 75 pound to 100 pound rating. Flat drawer shall be full extension ball bearing, 100 pound rated. File drawers shall be full extension, ball bearing 75 pound rated.

## 2.4 CABINET CONSTRUCTION

### A. CABINET COMPONENTS

1. Doors, drawer fronts and finished sides: Shall be a sandwich of decorative high pressure laminate on face side and liner high pressure laminate on back side. Permanently bonded under pressure to both surfaces, with a PVC self edge. Core shall be 11/16" forty-five (45) pound particle board.
2. Unexposed side: Shall have a sandwich of high pressure laminate on both surfaces with PVC edgebanding on 11/16" forty-five (45) pound particle board.
3. Drawers: Sides shall be 7/16" sanded hardwood with dovetail corner joints. Bottoms shall be 1/4" composition board dadoed into fronts, sides and backs.

### B. CABINET ASSEMBLY AND DETAILED REQUIREMENTS

1. All parts shall be accurately machined and fit for square and true cases. Case joints shall be rabbeted, glued, and attached with nails or screws. All backs, sub-tops and bottoms shall be rabbeted, glued and nailed at three (3) inches on center or the Blum fitting used. Upper cases shall also have nails

3" on center through back at top and bottom or the Blum fitting used.

2. All structural supports shall be concealed, installation of angles or rails permitted on interior of cabinet.
3. All base units except for sink cabinets shall have solid sub-top of 11/16" particle board.
4. All exposed edges on bottom of end and back of wall cabinets shall be edgebanded.
5. Cabinet bottoms on all wall hung cabinets shall be recessed 1/2".
6. Stretchers and rails shall be 3/4" edge banded particle board attached to side panel with steel angle braces.

C. PRE-FINISHED PORTABLE CASEWORK

1. Cabinets shall be constructed as for fixed cabinets except they shall be individual and designed to rest in a stable position without permanent attached to the structure. Provide finished ends on all cabinets. Floor standing units shall have finished bases and adjustable levelers or casters. Provide finished backs where noted.

2.5 ~~[Deleted]SINK UNIT CONSTRUCTION~~

~~A. DETAILED REQUIREMENTS~~

- ~~1. Each sink unit shall develop maximum strength and rigidity in each integral unit. Each unit shall be completely fabricated, ready for replacement in the laboratory equipment assembly, as detailed on the drawings and specified herein.~~
- ~~2. Each sink unit shall be molded with a minimum of 10 mil Gel Kote thickness.~~
- ~~3. Each unit shorter than 7 feet long shall be constructed with a minimum of four ounces of glass fiber per square foot. Units longer than seven feet shall be constructed with not less than 5 ounces of glass fiber mat per square foot.~~

- ~~4. The Gel Kote shall be applied to the mold in two coats and catalyzed with keytone peroxides not to exceed 2 1/2 percent. The first coat shall be completely cured prior to application of the second coat.~~
- ~~5. The back-up resin and reinforcing shall be applied in layers, working out air bells or voids between the Gel Kote and the mat. Extra layers of mat shall be used at points of stress.~~
- ~~6. The minimum fiberglass mat content shall be not less than 40 percent by weight.~~
- ~~7. Upon completion of the required mat layers, the sinks shall be bagged down under a vacuum and rolled out to insure proper and even distribution of the resin.~~
- ~~8. The units shall set and thoroughly cure under pressures of at least 1200 pounds per square foot, and shall be aged to obtain a minimum of 95 percent polymerization of the polyester resins.~~

## 2.6 FINISHES

### A. SINKS AND CABINETS

- ~~1. [Deleted]Finishes: Each sink unit shall be selected from standard Kreonite finishes.~~
2. Cabinet finishes shall be selected from the manufacturer's standard offering.

## 2.7 [Deleted]PLUMBING

### ~~A. FACTORY PLUMBING~~

- ~~1. Plumbing: Each sink unit shall be factory plumbed as shown on the drawings or specified herein.~~
- ~~2. All faucets, valves, spouts, vacuum breakers, circulation systems, temperature blenders, chilled water systems, compressed air systems, nitrogen systems, etc. shall be factory installed and connected as specified herein.~~
- ~~3. Each sink unit shall be factory plumbed for field connection of required services at the back or end of the unit; see plans for specific locations.~~

- ~~4. All faucet and control bodies, shall be heavy duty brass except those dedicated to deionized water and/or chemicals, which shall be polyvinyl chloride.~~
- ~~5. All connecting piping shall be heavy duty copper.~~
- ~~6. All plumbing shall be factory tested at 100 PSI hydrostatic pressure.~~

## 2.8 ELECTRICAL

### A. FACTORY ELECTRICAL

1. As shown on the plans or specified herein, sink units containing electrically controlled components shall be factory wired and connected within the unit, requiring only field connection to the properly rated electrical service.
2. For 115 volt service, either junction boxes (for direct wiring on site) or three prong, male, grounded connectors shall be provided, as applicable.
3. Junction boxes shall be provided for 208/230 volt service.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### A. JOB DIMENSIONS

1. Verify dimensions of all cabinet locations in building before fabrication.
2. Maximum filler size allowable 12" wide. Color and material same as face of adjacent cabinets.
3. Maximum scribe size allowable 1 1/2" wide wood made from suitable material.

#### B. INSTALLATION OF CABINETS

1. Shall be performed in a neat and professional manner in strict accordance with manufacturer's standards and shall be supervised by factory trained technicians.



2. All cabinets to be set plumb and level.
3. Adjust all doors, hinges, drawers, etc., after installation to provide proper operation.
4. Leave cabinetry clean and free of debris.
5. Installer shall be responsible for the immediate removal of all trash, crating, etc.

C. INSTALLATION FOR SINKS

1. Installation of sinks, provided under Section 11400, shall be by qualified craftsmen with experience in setting factory-built cabinets and/or making the required service connection.
2. All sink units shall be set in line and plumbed and leveled by means of the leveling legs provided with the support structure.
3. Sink unit field connections shall normally consist of 1/2" hot and tap water supply and 1 1/2" waste. However, as indicated on the plans and/or as specified herein, chilled water, compressed air, nitrogen, and electrical service may be required.
4. Attention is called to paragraph .03g.
5. Adjust all doors, hinges etc. after installation to provide proper operation.

3.2 WARRANTY

A. EQUIPMENT WARRANTY

1. Provide a written warranty indicating all work of this section will be free from defects in material and workmanship for a period of one (1) year after owner acceptance and that repairs or replacements of said defects shall be performed in a timely manner at no expense to the owner.

B. SINK UNIT WARRANTY

1. Kreonite Two-Year Sink Warranty: Kreonite, Inc. warrants to the original purchaser that Kreonite glass fiber laminated products shall be free of defects in workmanship and material for two (2) years from the date of installation acceptance.

END OF SECTION

SECTION 11471

ABS REVOLVING DARKROOM DOOR WITH SAFETY POP-OUT HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Revolving Darkroom Doors for light-safe handling of light sensitized materials with unrestricted easy operator access and exit for any type of darkroom.

- B. Accessories

1.2 RELATED SECTIONS

- A. Section 09260 - Gypsum Board Systems
- B. Section 09560 - Resilient Flooring: Termination Edging of Adjacent Floor Finish

1.3 ANSI A117.1

- A. Specifications for Mailing Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.4 SUBMITTAL: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate frame elevations, reinforcement, and finish.
- B. Product Data: Indicate frame configuration, anchor types and spacings, location of cut-outs for hardware, reinforcement.
- C. Samples: Submit two carrier samples of frame, 12 x 12 inch in size illustrating construction of frame and surface texture.
- D. Manufacturer=s Installation Instructions: Indicate special installation instructions.
- E. Manufacturer=s Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Certify that the material has been manufactured and tested in accordance with standard trade practices and is free from defects in material and workmanship at the time of shipment from the factory.

## 1.6 WARRANTY

- A. Provide warranty as follows: Should any door fail to perform as specified within a period of one year from the date of substantial completion, because of a factory defect in parts or workmanship, the manufacturer will correct or replace door.

## PART 2 PRODUCTS

- 2.1 Model to have an inside height of 74 :0, an entrance width of 360, and an overall diameter of 530. Darkroom door assembly to accommodate handicapped use.

## 2.2 DESCRIPTION

- A. Door: ABS Door is .100 thick Black LUSTRAN a rigid high-impact (Acrylonitrile Butadiene Styrene) manufactured by Monsanto Chemical Company. ABS is a petroleum hydrocarbon with a flash point 730-752 degrees. Flame class UL-94HB.
- B. Supports: The inner rotating cylinder is to be center suspended with a sealed thrust ball bearing rubber shock mounted. This cylinder is to be contained in a U-shaped track with formed steel side flanges to provide permanent rigidity.
- C. Paint: All corrosion treated steel parts are to be coated with Capital Flat Black #X12-55 paint to reduce reflection of stray light.
- D. Attachments: All entrances and exit openings are to be reinforced by 10 x 10 square aluminum tubing.
- E. Pop-out type breakaway system. J shaped aluminum extrusions with .250 recess are to be secured to the wall and identical extrusions are permanently fastened the outer cylinder door flanges. This is to be on the top and both sides of the door. The door is to be pushed into position and a 20 x .1250 flexible neoprene strip is inserted into the groove. Removal of the door is to be accomplished by pushing or pulling on the door. The flexible neoprene strip is to disengage from the extrusion, allowing immediate access. Provide bottom door casters at carpeted corridors to facilitate door movement.
- F. Flooring: Cover with a black rubber non-slip mat.
- G. Internal handrail: Operation from the inside of the door is to be facilitated by a handrail.
- H. External Finger Grips: Operation from the outside of the

door through recessed finger grips in the rotating cylinder.

- I. Fluorescent markers: Provide luminescent fluorescent markers for easy location in the dark when the door is rotated.
- J. Provide revolving cylinder plunger type security lock.
- K. Safety Light.
- L. Wheelchair access thresholds (Ramps) are to be provided.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that opening sized and tolerances are acceptable

#### 3.2 INSTALLATION

- A. Ship door boxed, skidded, and assembled, ready to install.

END OF SECTION



SECTION 12512

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 08520 - Aluminum Window: Wall opening head support brackets.

1.3 RELATED SECTIONS

- A. Section 06114 - Wood Blocking and Curbing: Wall opening head support blocking.
- B. Section 08520 - Aluminum Window: Window framing and interior reveals.

1.4 SYSTEM DESCRIPTION

- A. Horizontal slat louver blinds installed at window openings; manual control of raising and lowering by cord for full range locking; blade angle adjustable by control wand.

1.5 SUBMITTALS: Make submittals in accordance with Division 1.

- A. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- B. Product Data: Provide data indicating physical and dimensional characteristics, and operating features.
- C. Samples: Submit two samples, 1 inch (25.4 mm) long illustrating slat materials and finish, color, rod type and color.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

## 1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.8 COORDINATION

- A. Coordinate the work with window installation and placement of concealed blocking to support blinds.

## 1.9 EXTRA MATERIALS

- A. Provide 20 additional slats.
- B. Provide two additional complete blind assemblies of each size.
- C. Provide ten extra control rods.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Hunter Douglas Inc., Two Park Way  
Upper Saddle River, N.J.  
Product: Contract Viscount 1" Aluminum Blinds
- B. Levolar, 25 Grunpond Rd, Rockaway, N.J.  
Product: Riveria 1" Contract Blind
- C. Springs Window Fashions Division Inc.  
Product: Bali Classics Custom 1" wide aluminum blinds

### 2.2 MATERIALS

- A. Metal Slats: 1 inch (25 mm) wide; 0.011 inch (0.28 mm) thick spring tempered pre-finished aluminum horizontal slats, square slat corners, with manufacturing burrs removed.
- B. Slat Support: Woven polypropylene, ladder configuration.
- C. Head Rail: Pre-finished, formed steel box; internally fitted with hardware, pulleys, and bearings for operation.



- D. Control Wand: Extruded hollow plastic; square shape; non-removable type; length of window opening height less plus 3 inches, (75 mm).
- E. Head Support Bracket: Overhead head rail attachment; provide to Section 08520 for installation.
- F. Accessory Hardware: Type recommended by blind manufacturer.

## 2.3 FINISHES

- A. Blind Slat and Head Rail Housing: Bali #1093
- B. Control Wand: Bali #1093

## 2.4 FABRICATION

- A. Fabricate blinds to fit openings with uniform edge clearance of 1/8 inch (3.1 mm).

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed.

## 3.2 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.
- C. Place intermediate head supports at spacing recommended by the blind manufacturer.

## 3.3 INSTALLATION TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/8 inch (3.1 mm).
- B. Maximum Offset From Level: 1/8 inch (3 mm).

3.4 ADJUSTING

- A. Adjust blinds for smooth operation.

3.5 CLEANING

- A. Clean blind surfaces just prior to occupancy.

3.6 SCHEDULE

END OF SECTION

SECTION 14245

HYDRAULIC ELEVATORS - PASSENGER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hydraulic elevator system; hydraulic cylinder in buried casing.
- B. Passenger cab with doors and frames; hoistway entrance doors and frames.
- C. Excavating and backfilling for plunger casing.
- D. Motor and pump, controllers, hoistway, equipment, and accessories.
- E. Batteries furnished and installed for the following:
  - 1. Provide 90 minutes of cab lighting.
  - 2. Automatic switchover to batteries to lower cab to ground floor when power outage occurs.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete: Concrete for elevator motor and pump foundation, and pit, grouting thresholds, and temporary machine room floor slab.
- B. Section 04311 - Concrete Unit Masonry: Building-in and grouting hoistway door frames; masonry hoistway enclosure.
- C. Section 05120 - Structural Steel: Hoistway framing, divider beams, and overhead hoist beams.
- D. Section 05500 - Metal Fabrications: Pit ladder, Sill supports.
- E. Section 07120 - Fluid Applied Waterproofing: Waterproofing of elevator pit walls and floor.
- F. Section 09260 - Gypsum Board Systems: Gypsum shaft walls.
- G. Section 09650 - Resilient Flooring: Floor finish in cab.
- H. Section 10522 - Fire Extinguishers, Cabinet, and Accessories: Fire extinguisher in elevator machine room.

- I. Section 16111 - Conduit: Empty conduit to elevator equipment devices remote from elevator machine room or hoistway.
  - J. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.
  - K. Section 16180 - Equipment Wiring Systems: Electrical service to main disconnect in elevator machine room including electrical power for elevator installation and testing.
  - L. Section 16180 - Equipment Wiring Systems: Electrical service for machine room, pit.
  - M. Section 16180 - Equipment Wiring Systems: Lighting in elevator pit.
  - N. Section 16180 - Equipment Wiring Systems: Empty conduit for telephone service elevator.
  - O. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire and smoke detectors and interconnecting devices.
  - P. Section 16721 - Fire Alarm and Smoke Detection Systems: Fire alarm signal lines to elevator controller cabinet.
- 1.3 REFERENCES (Latest edition)
- A. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
  - B. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
  - C. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators.
  - D. ANSI/ASME A17.2 - Inspector's Manual For Elevators and Escalators.
  - E. ASTM A36 - Structural Steel.
  - F. ASTM A366 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
  - G. ANSI/AWS D1.1 - Structural Welding Code, Steel.
  - H. ANSI/NFPA 70 - National Electrical Code.

- I. ANSI/NFPA 80 - Fire Doors and Windows.
- J. ANSI/UL 10B - Fire Tests of Door Assemblies.
- K. APA - American Plywood Association.
- L. ASTM A139 - Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4-in. and Over).
- M. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- N. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- O. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- P. NEMA LD3 - High Pressure Decorative Laminates.
- Q. NEMA MG1 - Motors and Generators
- R. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual.

#### 1.4 SYSTEM DESCRIPTION

- A. Hydraulic Elevator System: One units; buried cylinder and casing; with motor and pump adjacent approximately 2 feet (0.61 m) distant from the hoistway.
- B. Characteristics of elevator #1.
  - 1. Rated Net Capacity: 2000 lbs.
  - 2. Rated Speed: 125 ft/min.
  - 3. Nominal Platform Size: 72" x 55" inches (1829 x 1397 mm).
  - 4. Clear Net Platform Size: 68" x 51" inches.
  - 5. Cab Height: 96 inch.
  - 6. Hoistway and Cab Entrance Frame Opening Sizes: 36 x 84 inches (914 x 2134 mm).
  - 7. Door Type: Single slide, left hand.
  - 8. Door Operation: Side opening.

9. No. of Stops: one.

10. No. of Openings: two Front.

C. Door Control Features:

1. Program door control to open doors automatically when car arrives at floor.
2. Render "Door Close" button inoperative when car is standing at dispatching terminal with doors open.
3. If doors are prevented from closing for approximately ten seconds because of an obstruction, automatically disconnect door reopening devices, close doors more slowly until obstruction is cleared. Sound buzzer.
4. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equip with [photo-electric light rays.] [object proximity detector device.]

D. Interconnect elevator control system with building fire alarm, smoke alarm, system.

E. Temporary Elevator Use: Enclose elevator early for transport of construction personnel.

1. Enclose cab with protective plywood on floor, walls, and ceiling.
2. Provide temporary lighting.
3. Provide control panel with manual and emergency operation with key operation for attendant operator.

F. Seismic Design: In accordance with applicable local code.

1.5 TWO-STOP AUTOMATIC OPERATION

- A. Set system operation so that upon momentary pressure of a hall button from another landing, dispatch car to that landing.
- B. Allow call registered by momentary pressure of hall button at any time, to remain registered until car stops in response to that call at that landing.

- C. If hoistway door car gate is not opened within a short interval after car has stopped at terminal, allow car to respond to any call from the other landing.

1.6 FIREFIGHTER'S SERVICE

- A. Provide "Firefighter's Operation" in accordance with ANSI/ASME A17.1.
- B. Designated Landing: Ground Floor.

1.7 INDEPENDENT SERVICE

- A. Provide key operated "Independent Service" on car operating panel. Key activation will remove that car from normal operation and cancel all pre-registered car calls.
- B. Car will respond to selected floor. Car will not respond to any calls from hall call buttons. Car will only respond to calls placed on the car operating panel. Doors will remain open at last landing requested. Doors will close with a constant pressure on "DOOR CLOSE" button.
- C. Key activation to normal operation will return car to normal operation.

1.8 SUBMITTALS: Submit under provisions of Division 1.

- A. Shop Drawings: Indicate the following information:
  - 1. Motor and hydraulic pump, valves, controller, selector, governor and other component locations.
  - 2. Car, machine beams, guide rails, buffers, and other components in hoistway.
  - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
  - 4. Individual weight of principal components; load reaction at points of support.
  - 5. Loads on hoisting beams.
  - 6. Clearances and over travel of car.
  - 7. Location of components in machine room.

8. Locations in hoistway and machine room of connections for car light and telephone.
9. Location and sizes of access doors, doors, and frames.
10. Expected heat dissipation of elevator equipment in machine room.
11. Applicable seismic design data; certified by a Registered Professional Structural Engineer.
12. Electrical characteristics and connection requirements.
13. Show arrangement of equipment in machine room so moving elements and other equipment can be removed for repairs or replaced without disturbing other components. Arrange equipment for clear passage through access door.

B. Product Data: Provide data on the following items:

1. Signal and operating fixtures, operating panels, indicators.
2. Cab design, dimensions, layout, and components.
3. Cab and hoistway door and frame details.
4. Electrical characteristics and connection requirements.

C. Samples: Submit two samples, 6 x 6 inch (150 x 150 mm) in size illustrating cab floor material, cab interior finishes, cab and hoistway door and frame finishes.

1.9 OPERATION AND MAINTENANCE DATA

- A. Include a parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
- B. Provide technical information for servicing operating equipment.
- C. Include legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment, and changes made in the Work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.



- D. Provide one copy of master electric and hydraulic schematic and one copy of lubrication chart, each framed with clear plastic; mount on machine room wall.

#### 1.10 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI/ASME A17.1, ANSI/AWS D1.1, NFPA 70, AISC, and as supplemented in this section.
- B. Fabricate and install door and frame assemblies in accordance with ANSI/NFPA 80 and ANSI/UL 10B.
- C. All electronic elevator equipment and controls covered by this section shall be year 2000 compliant.

#### 1.11 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.
- B. Installer: Employees and supervisor on payroll of elevator equipment manufacturer.

#### 1.12 REGULATORY REQUIREMENTS

- A. Conform to applicable local code for manufacture and installation of elevator system.
- B. Conform to ANSI A17.1 for provisions for the physically handicapped.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### 1.13 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

#### 1.14 WARRANTY

- A. Provide one year manufacturer's warranty.
- B. Warranty: Include coverage for elevator operating equipment and devices.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Dover Elevator Company: Model Fleetwood 2100.
- B. Otis Elevator Company: Model LRV2000.
- C. Schindler Elevator Corp.: Model Fastrack 20H.

### 2.2 MATERIALS

- A. Rolled Steel Sections, Shapes, Rods: ANSI/ASTM A36.
- B. Casing: ASTM A139, Grade A steel.
- C. Sheet Steel: ANSI/ASTM A366 Class 1, with matte finish. ASTM A446 Grade B, zinc coated to G90.
- D. Stainless Steel: ASTM A167 Type 304, No. 4 finish.
- E. Aluminum: ASTM B221, extruded.
- F. Plywood: APA Structural I, Grade C-D, sanded.
- G. Plastic Laminate: NEMA LD3, GP-50 type, 3/4 inch (19 mm) thick; solid (one surface color) color/pattern and matte surface finish: AFormica $\cong$  Mink Scorpie 256-58

### 2.3 FINISH MATERIALS

- A. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- B. Primer for Wood Surfaces: Alkyd primer sealer.
- C. Finish Paint (for Metal Surfaces): Alkyd enamel, semi-gloss color as selected.
- D. Finish Paint (for Wood Surfaces): Alkyd enamel, semi-gloss color as selected.

### 2.4 EQUIPMENT

- A. Motor, Pumps, Valves, Regulators, Fluid Tank, Hydraulic Fluid, Controller, Controls, Buttons, Wiring and Devices, Indicators: Required by ANSI/NFPA 70.
- B. Guide Rails, Cables, Spring Buffers, Attachment Brackets and Anchors: Purpose designed, sized according to code with safety factors.

## 2.5 ELECTRICAL CHARACTERISTICS AND COMPONENTS

### A. Electrical Characteristics:

1. 20 hp.
2. 480 volts, three phase, 60 Hz.
3. Overcurrent protection integral with equipment shall be sized by the manufacturer based upon exact supplied equipment, starting characteristics, etc.
4. Starter Characteristics: Reduced voltage Wye-Delta type with a maximum of 47 starting amps at rated voltage.
5. Refer to Section 16180.

### B. Motor: Refer to Section 15170.

### C. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 16180.

## 2.6 ELECTRICAL COMPONENTS

- A. Boxes, Conduit, Wiring, and Devices: Required by ANSI/NFPA 70.
- B. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are acceptable only when a separate grounding conductor is also installed across the joint.
- C. Spare Conductors: Include 10 percent extra conductors and two pairs of shielded audio cables in traveling cables. Do not parallel conductors to increase electric current capacity unless individually fused.
- D. Do not use armored flexible metal conduit as a grounding conductor.
- E. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms. Provide additional components and wiring to suit machine room layout.

## 2.7 LUBRICATION

- A. Grease Fittings: For lubricating bearings requiring periodic lubrication.
- B. Grease Cups: Automatic feed type.
- C. Lubrication Points: Visible and easily accessible.

## 2.8 CAR FABRICATION

- A. Frame: Rigid and braced, rolled or formed steel sections, mounted on resilient isolators.
- B. Platform: Steel frame, with fireproofed plywood subflooring assembly, ready to receive floor finish.

## 2.9 CAB FABRICATION

- A. Flooring: Resilient tile flooring, of type specified in Section 09650.
- B. Walls: Plastic laminate on plywood.
- C. Front Return Panel: Baked enamel on steel.
- D. Base: Resilient rubber cove, of type specified in Section 09650.
- E. Ceiling: Plastic eggcrate diffuser. Accommodate a raised ceiling above finished ceiling to 96 inches (2439 mm) high, to the rear of the overhead cross beam.]
- F. Light Fixtures: Fluorescent light troughs.
- G. Ventilation: Single speed fan, grille above ceiling; perforations in base.
- H. Control Panel and Face Plate: Stainless steel with illuminating call buttons.
- I. Indicator Panel: Above door with illuminating position indicators.
- J. Hand Rail: Stainless steel flat bar stock, spaced from wall 1.5 inches (38 mm); placed at rear wall and side walls.

- K. Pad Hooks: Stainless steel type, mounted at 72 inches (823 mm) high, in the cab.
- L. Protective Pads: One set, canvas cover, padded with [cotton wadding] fill material, sewn with piping edges; brass grommets spaced to match pad hook spacing in cab, covering side and rear walls and front return, except cut-out for control panel. Install pad hooks to match pad grommets in FAC. Maint. storage room 102 as indicated.
- M. Certificate Frame and Glazing: Stainless steel frame, clear tempered glass attached with tamper proof screws.

#### 2.10 CAB ENTRANCES

- A. Cab Doors: Baked enamel on steel; 16 gage (1.5 mm) thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction. Fabricate front return panels same as doors.
- B. Cab Door Frames: Baked enamel on steel; 16 gage (1.5 mm) thick metal, welded corner design with smooth invisible joints.
- C. Thresholds: Extruded aluminum type, to align with frame return to allow reversing of cab carpet floor finish.

#### 2.11 HOISTWAY ENTRANCES

- A. Hoistway Doors (Main Floor): Baked enamel on steel; 16 gage (1.5 mm) thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction.
- B. Hoistway Door Frames (Main Floor): Baked enamel on steel; 16 gage (1.5 mm) thick metal, of rolled profiles, welded corner with smooth invisible joints.
- C. Hoistway Doors (Other Floors): Baked enamel on steel; 16 gage (1.5 mm) thick metal, of hollow insulated sandwich panel construction, flush design, rolled profiles, rigid construction.
- D. Hoistway Door Frames (Other Floors): Baked enamel on steel; 16 gage (1.5 mm) thick metal, of rolled profiles, welded corner with smooth invisible joints.
- E. Door and Frame Construction: UL 1-1/2 hour fire rating; insulated sandwich panel door construction 1-1/4 inch (32 mm) thick, minimum.

F. Weatherstrip hoistway doors and frames to minimize audible noise caused by air movement, imposed by car movement in the hoistway, and air pressure differential between hoistway and landing floors.

G. Sills: Extruded aluminum.

## 2.12 FINISHES

A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

B. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.

C. Galvanized Surfaces: Clean with neutralizing solvent; prime one coat.

D. Aluminum: Clear anodized

E. Wood Surfaces not Exposed to Public View: One coat primer; one coat enamel.

F. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two coats of enamel sprayed and baked; color as selected.

G. Stainless Steel: No. 4 brushed.

## 2.13 MACHINE ROOM INTERFACING MONITOR

A. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:

1. Hall and car registration circuits.
2. Load weighing circuits.
3. Up and down peak programming circuits.
4. Independent service switches.

B. Label terminals for use with alligator test clips.

## 2.14 CAR OPERATING PANEL

A. Provide one flush mounted operating panel per car with applied face plate with an integral and front return face plate; with front return panels containing illuminated call buttons corresponding to floors served, in car alarm button, and DOOR OPEN DOOR CLOSE buttons.

- B. Position alarm button where it is unlikely to be accidentally actuated; not more than 54 inches (1 370 mm) above cab floor.
- C. Include service cabinet, with hinged door and lock in each car.
- D. Locate a 110 V, 15 A convenience receptacle below service cabinet.
- E. Car Position Indicators:
- F. Emergency Light:
- G. Telephone Cabinet:

#### 2.15 LANDING CONTROLS

- A. Landing Buttons: Illuminating type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows including indications required by ANSI A117.1.
- B. Landing Position Indicators: Illuminating white.
- C. Car Direction Indicators: Illuminating white.

#### 2.16 PROVISION FOR HANDICAPPED

- A. Comply with ANSI A117.1.
- B. Provide indicators near controls in conformance with ANSI A117.1.
- C. Landing Buttons: Illuminating type, one for originating UP and one for originating DOWN calls, one button only at terminating landings; marked with arrows including indications required by ANSI A117.1.
- D. Locate highest button in elevator cab control panel and the center of the telephone handset, not more than 54 inches (1 370 mm) above floor level.
- E. Hand Rails: Rectangular profile of 1.5 inch (38 mm) wide x 1/4 inch (6 mm) thick, solid stainless steel; position on one three sides of cab with ends returned.
- F. Sound audible tone signal in car when car is stopping at a floor or passing a floor.

- G. Include with illuminated landing indicators, audible tone signals; once for UP stops and twice for DOWN stops.
- H. In each cab provide Arabic numerals 5/8 inch (16 mm) in height raised 0.03 inch (0.8 mm) Braille numerals immediately to left of floor buttons to identify each floor.
- I. At each floor landing provide 2 inch (50 mm) floor numerals raised 0.03 inch (0.8 mm) on door frame jamb.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that hoistway, pit, and machine room are ready for work of this section.
- B. Verify hoistway shaft and openings are of correct size and within tolerance.
- C. Verify location and size of machine foundation and position of machine foundation bolts.
- D. Verify that electrical power is available and of the correct characteristics.

### 3.2 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components.

### 3.3 EXCAVATION AND BACKFILLING FOR CASING

- A. Excavating: Refer to Division 2.
- B. Maintain shaft alignment of 1 inch (25 mm) from plumb. Fill over excavated shaft depth with lean concrete.
- C. Maintain shaft excavation free of water.
- D. Place plunger casing full depth of shaft. Align to 1/4 inch (6 mm) from plumb. Cut top of casing at hoistway pit slab elevation.
- E. Backfilling: Refer to Section Division 2.



- F. Backfill with granular soil fill with 50% or more by weight of representative sample is retained on the U.S. Standard #200 sieve, placed in 12 inch (300 mm) lifts compacted to 90% of the maximum density as determined by ASTM D698-78.

### 3.4 INSTALLATION

- A. Install in accordance with ANSI/ASME A17.1.
- B. Install system components. Connect equipment to building utilities. Install piping between hoistway plunger and pump unit.
- C. Provide conduit, boxes, wiring, and accessories.
- D. Mount motor and pump unit on vibration and acoustic isolators, on bed plate and concrete pad. Place unit on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.
- E. Accommodate equipment in space indicated.
- F. Install guide rails using threaded bolts with metal shims and lock washers under nuts. Compensate for expansion and contraction movement of guide rails.
- G. Accurately machine and align guide rails. Form smooth joints with machined splice plates.
- H. Bolt or weld brackets directly to structural steel hoistway framing.
- I. Field Welds: Chip and clean away oxidation and residue, wire brush; spot prime with two coats.
- J. Coordinate installation of hoistway wall construction.
- K. Install hoistway door sills, frames, and headers in hoistway walls. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.
- L. Fill hoistway door frames solid with grout in accordance with Section
- M. Adjust equipment for smooth and quiet operation.

### 3.5 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other within 1/8 inch (3 mm). in accordance with ANSI/ASME A17.1 and ANSI/ASME A17.2.
- B. Cab Movement on Aligned Guide Rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration.

### 3.6 TESTS BY REGULATORY AGENCIES

- A. Testing by regulatory agencies will be performed at their discretion; documented by the Contractor under provisions of Division 1.
- B. Obtain required permits to perform tests. Perform tests required by regulatory agencies.
- C. Schedule tests with agencies, Architect/Engineer and Contractor present.
- D. Furnish test and approval certificates issued by jurisdictional authorities.

### 3.7 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.
- B. Adjust automatic floor levelling feature at each floor to achieve 1/4 inch (6 mm) from flush.

### 3.8 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components ready for inspection.

### 3.9 PROTECTION OF FINISHED WORK

- A. Do not permit construction traffic within cab after cleaning.

END OF SECTION

## SECTION 15010

### BASIC MECHANICAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Basic Mechanical requirements that are applicable to all Division 15 sections in addition to Division 0 - Contract Requirements and Division 1 - General Requirements.
2. Mechanical work covered by all sections within DIVISION 15 - MECHANICAL of these Specifications, including but not limited to:
  1. Heating, ventilating, air conditioning and refrigeration systems and equipment.
  2. Plumbing systems and equipment.
  3. Fire protection systems and equipment.

##### 1.2 RELATED SECTIONS

1. Division 0 - Contract Requirements
2. Division 1 - General Requirements
3. Division 3 - Concrete
4. Division 9 - Finishes
5. Division 11 - Equipment
6. Division 12 - Furnishings
7. Division 14 - Conveying Systems
8. Division 16 - Electrical
9. Divisions 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to all work included in this section. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this and the other sections of Division 15.

10. This section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
11.
  1. Reference Standards, Codes and Fees
  2. Quality Assurance
  3. Submittals
  4. Maintenance Manuals
  5. Job Conditions
  6. Accuracy of Data and Drawings
  7. Electrical Requirements for Mechanical Equipment
  8. Coordination Drawings
  9. Record Documents
  10. Identification
  11. Fire-Stop Materials
  12. Rough-ins
  13. Field Tests
  14. Excavation and Backfill
  15. Adjusting and Cleaning
  16. Installation
  17. Removal and Relocation of Existing Work
  18. Painting

### 1.3 CONTRACTOR'S RESPONSIBILITY

1. The Contractor shall obtain and pay for all licenses and permits required to perform work covered by DIVISION 15 -MECHANICAL, and obtain and

pay for all necessary inspections by all applicable authorities.

#### 1.4 CODES AND STANDARDS

1. In addition to requirements of Divisions 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS, all work shall be manufactured, installed and labeled in accordance with the applicable provisions of the latest editions of the following codes and standards, including addenda and modifications made by local authorities.

1. Local Codes
2. State Codes
3. Federal Codes
4. ASME Boiler Code
5. AGA - American Gas Association
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. AABC - Associated Air Balance Council
8. NEMA - National Electrical Manufacturer's Association
9. ANSI - American Society National Standards Institute
10. ASME - American Society of Mechanical Engineers
11. NFPA - National Fire Protection Association
12. NFPA - 101 Life Safety Code
13. ARI - Air-Conditioning and Refrigeration Institute
14. UL - Underwriters Laboratories, Inc.
15. BOCA National Codes - Building, Mechanical, Plumbing, Fire Prevention, Existing Structures, Sewage Disposal, Energy, Etc.

16. Uniform Codes - Building, Mechanical, Plumbing, Fire Prevention, Etc.
17. National Codes - Building, Mechanical, Plumbing, Fire Prevention, Etc.
18. ASPE - American Society of Plumbing Engineers.
19. OSHA - Occupational Safety and Health Act.
20. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc. 1985 HVAC Duct Construction Standards.

1.5 GOVERNMENT FURNISHED EQUIPMENT AND INSTALLATION

1. Refer to Divisions 0 and 1.

1.6 WORK SEQUENCE

1. Refer to Divisions 0 and 1.

1.7 FUTURE WORK

1. Refer to Divisions 0 and 1.

1.8 ALLOWANCES

1. Refer to Divisions 0 and 1.

1.9 UNIT PRICES

1. Refer to Divisions 0 and 1.

1.10 ALTERNATES

1. Refer to Divisions 0 and 1.

1.11 QUALITY ASSURANCE

1. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section and with all applicable national, state, and local codes.
2. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-mounted elements.

3. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.
4. Capacities, ratings, sizes and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.
5. All electronically operated equipment and controls covered by this section shall be year 2000 compliant.

1.12 PROVIDE

- A. Provide 1 copy of detailed and simplified one line, color coded flow and wire diagrams mounted in plexiglas picture framed mounted on an appropriate wall in mechanical room 217.

1.13 ELECTRICAL CHARACTERISTICS, MOTOR SIZES, MOTOR STARTERS, CONTROLS, AND WIRING

1. DIVISIONS 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to the work related in this section.
2. Motor starters and other electrical control devices: Generally, motor starters for equipment motors shall be furnished by DIVISION 16 - ELECTRICAL; however, this section shall furnish ONLY those motor starters which may be specified hereinafter in this Section. Also, this section shall furnish all other electrical control devices required for the Mechanical system, unless otherwise specified.
3. Installation of electrical devices, EXCEPT those factory mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by DIVISION 16 - ELECTRICAL. All control devices which are not factory mounted on the equipment and require piping, linkage, remote bulb, or other mechanical connections as well as electrical connections shall be installed by the Section that furnished the equipment involved, ready for electrical connection.

1. Electric wiring: Division 15 shall perform any and all control and interlock wiring necessary for the operation sequence described in Section 15950 or on mechanical plans with properly licensed personnel. Any wiring requirements for control devices furnished under Division 15 shall be provided by Division 15. Wiring for control devices not furnished by Division 15 or devices that are factory mounted on mechanical equipment requiring electrical connections only shall be by Division 16. Division 16 shall provide dedicated 120 VAC, 15-20 amp power to designated control panel locations. Exact locations shall be coordinated between Division 15 and 16.
2. All necessary interlocking contacts and remote starting contacts and remote starting devices not installed on local control panels shall be supplied with the starters and it shall be the responsibility of Division 15 to coordinate the number of contacts required. If individual control transformers are required, provide the transformers necessary for the additional power required by auxiliary control devices. This coordination shall occur prior to ordering starters and the cost shall be included in the bid proposal.
3. Control wiring materials and installation shall conform to Division 16 requirements.

## PART 2 PRODUCTS

### 2.1 HOUSEKEEPING PADS

1. Provide 4" (102 mm) concrete pads for all floor mounted mechanical equipment such as circulating pumps, boilers, air handling units, water heaters, etc. Pad dimensions shall be approximately 6" (152 mm) inches larger than the equipment in the width and depth dimensions. Bevel the edges of the pad to reduce chipping. Refer to section 03300 for concrete specifications.



## PART 3 EXECUTION

### 3.1 ROUGH-IN

1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
2. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

### 3.2 FIELD TESTS

1. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes, after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by the and all applicable authorities. Submit results for review.
2. Provide required labor, material, equipment and connections.
3. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi (690 kpa), whichever is higher, AFTER removing all air from piping involved in test.
4.
  1. Natural gas piping: 50 psi (345 kpa) test using air or inert gas.
  2. Soil, waste, vent, roof drainage, and acid waste piping: standard water test, by filling piping with water up to top of vent

stack or highest point of piping test section involved, but no section tested with less than a ten foot head with no pressure loss for at least 30 minutes.

3. Fire protection piping: 200 psi (1380 kpa) two hour duration hydrostatic test, AFTER removing all air from piping involved in test, with pressure gauged at bottoms of standpipes. Conduct this test in presence of authorized representative of the Fire Department having jurisdiction.
4. Chilled water and heating water piping: Water test at 150% of normal working pressure of piping involved, or 100 psig (690 kpa), whichever is higher.
5. Test all equipment in accordance with sections specified hereinafter.
5. Test all ductwork constructed to 2" (500 pa) W.G. class or higher, in accordance with leakage test method recommended in 1985 SMACNA "Duct Construction Standards". After remedying audible leaks, total leakage on system shall not exceed one percent of system total design air flow rate.

### 3.3 ADJUSTING AND CLEANING

1. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.
2. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.
3. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all necessary adjustments, and remove all air from water circulating systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide

uniform air flows and uniform temperatures in air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

4. Sterilization of Domestic Water System: AFTER all water connections have been made to all fixtures and equipment, and BEFORE plumbing system is used by Owner, sterilize entire potable water system as specified below, and submit a written report certifying that this has been done in accordance with the requirements of the State Department of Public Health.
  1. Drain entire water system.
  2. Refill entire water system with a sterilizing solution of potable water containing at least 50 parts per million of available chlorine.
  3. Allow sterilizing solution to remain in water system for at least 24 hours, then drain all sterilizing solution from water system.
  4. With potable water, flush all traces of sterilizing solution from entire water system through each fixture and each water outlet.
5. Strainers and Dirt Pockets: Clean out each of these; REMOVE EACH STRAINER SCREEN FOR CLEANING. Initially install very fine mesh screen for system cleaning and operate System to a minimum of 24 hours. Remove screen, clean it and replace it in system until a clean system is verified. Remove screen and replace with screen at mesh for normal operation.
6. Circulating Water Systems: Completely drain each of these, and refill with clean water.
7. After systems have been tested and before putting any part of or the entire system in operation for Owner's beneficial use, insure that all necessary adjustments have been made.
  1. Bearings and other items requiring lubrication, except factory permanently lubricated type: lubricate each of these as recommended by its manufacturer; this includes lubricated type plug valves.

2. Belts: adjust each of these to proper tension.
3. Filters: replace each disposable ("throw away") filter with a new clean filter (except blanket roll and high efficiency type). Clean each cleanable filter. NOTE: ALL FILTERS SHALL BE IN PLACE DURING TESTING AND ADJUSTING AND SHALL BE CLEAN.
4. Motor load tests: make an ammeter check of actual running current of each motor in mechanical system under operating conditions. Correct all motors which are found to be overloaded, as approved.

#### 3.4 INSTALLATION

1. General: Sequence, coordinate and integrate the various elements of mechanical systems, materials, and equipment.
2. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions. Coordinate mechanical systems, equipment, and materials installation with other building components. Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, fire protection, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement will not be considered. Each bidder shall determine before bidding that equipment upon which the proposed bid is based will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this for resolution before proceeding with the work involved.

3. Equipment NOT furnished by mechanical section but requiring mechanical connections from other Sections and others furnishing this equipment, determine exact mechanical connection requirements therefor; locations and arrangements of connections indicated for this equipment are APPROXIMATE ONLY.
4. Arrange for chases, slots and openings in other building components during progress of construction, to allow for mechanical installations.
5. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
6. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
7. Where installation heights are not detailed or dimensioned, and equipment requires periodic service, verify height prior to installation, otherwise install to provide the maximum headroom possible.
8. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.
11. Generally, install pipework and ductwork as follows unless otherwise indicated.

1. Finished areas: conceal pipework and ductwork within pipe chases, above suspended ceiling and within other building construction, in offices, rest rooms, and other finished areas, unless otherwise indicated.
2. Unfinished areas: install above ground pipework and ductwork exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms or storage areas, and other unfinished areas.
3. ALL areas: install pipework and ductwork parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework and ductwork as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

### 3.5 REMOVAL AND RELOCATION OF EXISTING WORK

1. Disconnect, remove or relocate material, equipment, piping, and other work noted and required by removal or changes in existing construction.
2. Provide new material and equipment related to relocated equipment.
3. Plug or cap active piping or ductwork behind or below finish.
4. Do not leave long dead end branches:
  1. Cap or plug as close to active line as possible.
5. Salvaged Existing Mechanical Materials and Equipment: Promptly haul away from Owner's premises all materials and equipment which are removed from existing system and are neither indicated nor required to be reused in the

completed project, EXCEPT as otherwise specified.

Owner may select certain removed existing materials and equipment and retain them for his future use. Before removing any existing materials and equipment, determine from Owner which of these materials and equipment is to be retained by the Owner. Remove all Owner selected materials and equipment with unnecessary damage thereto, and safely store them at locations designated by Owner.

### 3.6 PAINTING

1. All surfaces shall be left clean and free from oil.
2. All equipment shall be factory prime coated and painted; however, the following may be shop prime coated and made ready for painting:
  1. Tanks.
  2. Structural supports and frames.
3. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.
4. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.
5. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.
6. All ductwork, conduit, insulation, pipe, and structures visible through grilles and diffusers shall be painted flat black.
7. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.
8. Provide enamel paint where specified.
9. Refer to Section 09900 for Painting.

### 3.7 IDENTIFICATION OF VALVING AND EQUIPMENT

1. Identify valves, (including main pipe sectionalizing valves and branch valves) except

those on or within hand reach of equipment controlled thereby with a minimum 1-1/2 inch (38 mm) diameter round brass or aluminum tag stamped with 1/4 inch (6 mm) (minimum) height letters designating material controlled by valve, and attached to valve body with 18 (minimum) gauge (1.3 mm) solid copper or galvanized steel wire. Submit a typed valve identification schedule with the operating instructions and parts list submittal described above under article 1.12 SUBMITTALS AND SHOP DRAWINGS.

2. Equipment: Label each major mechanical equipment item (such as AHU, pump, fan, boiler, water heaters, etc.) with nameplate engraved with equipment designation and number, and securely attached to equipment.
3. Refer to Section 15190 for Mechanical Identification.

### 3.8 IDENTIFICATION OF PIPING

1. Identify piping with self-sticking vinyl cloth pipe markers and pipe marker arrows, each sized as recommended by marker manufacturer for outside diameter of pipe (including pipe insulation) labeled therewith. Marker background colors shall conform to OSHA, NFPA and ANSI pipe identification standards as scheduled in Table (I). Each pipe marker shall be lettered to indicate the material contained in the pipeline involved and arrows shall indicate direction of material flow in the pipelines.
2. Provide a full color piping Identification Schedule indicating material type within pipe and its corresponding color coding.
3. Locate Identification As Follows:
  1. Mechanical Equipment Rooms:
    1. Within 1'-6" (0.46m) of each valve or valve assembly.
    2. Within 3'-0" (0.92m) of each 90 deg (1.57 Rad) elbow, connection to equipment or vessel, point where pipe enters shafts and pierces outside walls.



3. On not over 20'-0" (6.1 m) intervals along all exposed piping.
2. Above Suspended Ceilings:
  1. Within 1'-6" (0.46 m) of each valve or valve assembly.
  2. At tees within 3'-0" (0.92 m) of both main and branch.
  3. Within 3'-0" (0.92 m) of each 90 deg (1.57 Rad) elbow.
3. Piping Concealed in Chases or Shafts:
  1. Each pipe visible through an access door or panel.
4. Piping Exposed in Rooms Other than Mechanical Equipment Areas:
  1. Omit identification of piping, 1/2" (13 mm) and smaller, exposed at connections to equipment or plumbing fixtures.
  2. With the above exception, identify at not less than (1) point each piping run visible in each room with identification on not over 20'-0" (6.1 m) intervals.
4. Refer to Section 15190 for Mechanical Identification.

TABLE I  
SCHEDULE OF PIPING IDENTIFICATION

<u>CLASSIFICATION (Per ANSI A13.1)</u>	<u>BACKGROUND COLOR</u>	<u>LETTERING</u>
Chilled Water Supply	Green	White
Chilled Water Return	Green	White
Natural Gas Piping	Yellow	Black
Domestic Cold Water	Green	White
Domestic Hot Water Supply	Green	White
Domestic Hot Water Return	Green	White
Equipment Drains, Roof Drains	Green	White
Sanitary Drains, Storm Drains	Green	White
Fire Protection Water	Red	White
Hot Water Supply From Boiler	Yellow	Black
Hot Water Return to Boiler	Yellow	Black
Plumbing Vent Lines	Green	White

### 3.9 FIRE-STOP MATERIALS

1. Seal around all pipes, ducts, and conduit penetrating fire-rated partitions, in accordance with manufacturer's instructions. Caulk and putty shall be applied to the proper depth for the fire rating required, as listed in the manufacturer's instructions.

END OF SECTION

SECTION 15121

PIPING EXPANSION COMPENSATION

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Flexible pipe connectors.

1.2 RELATED SECTIONS

1. Section 15330 - Fire Protection Piping.
2. Section 15410 - Plumbing Piping.
3. Section 15510 - Hydronic Piping.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

1. ASTM A 36/A 36M - Specification for Structural Steel.
2. ASTM A 53 - Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
3. ASTM A 183 - Carbon Steel, Track Bolts and Nuts.
4. ASTM A 780 - Repair of Damaged Hot-Dipped Galvanized Coatings.
5. ASTM F 844 - Washers, Steel, Plain (Flat), Unhardened for General Use.
6. ASME B18.10 - Track Bolts and Nuts.
7. ASME B31.9 - Building Services Piping.
8. ASME Boiler & Pressure Vessel Code Section II "Material Specifications" And Section IX "Welding and Brazing Qualifications".
9. AWS D1.1 - Structural Welding code - Steel.
10. EJMA Standards.

11. SSPC - PA - Paint Application Specification No. 1, Shop, Field, and Maintenance Painting.

#### 1.4 SUBMITTALS

1. Government approval is required for submittal with a OGAO designation; submittal having and OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
2. Product Data:
  1. Flexible Pipe Connectors: Provide schedule which shows manufacturer's figure number, size, location and indicates maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  3. Welders Certificates: Contractor shall sign welders certificates, certifying that welders comply with requirements specified under Qualifications.
  4. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

#### 1.5 PROJECT RECORD DOCUMENTS

1. Submit under provisions of Section 15010.
2. Record actual locations of flexible pipe connectors.

#### 1.6 QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
2. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code - Steel".
  1. Certify that each welder has satisfactorily passed AWS qualification tests for welding

processes involved and, if pertinent, has undergone recertification.

3. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

#### 1.7 DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.

#### 1.8 WARRANTY

1. Provide five year warranty under provisions of Divisions 0 and 1.

### PART 2 PRODUCTS

#### 2.1 FLEXIBLE PIPE CONNECTORS

1. Steel Piping:
  1. Acceptable Manufacturers:
    - a. Mason Industries, Inc.
    1. Senior Flexonics, Inc.
    2. Proco Products, Inc.
    3. Hyspan Precision Products, Inc.
    4. Twin City Hose, Inc.
    5. Metraflex Company.
    6. Approved equal under provisions of Divisions 0 and 1.
  2. Inner Hose: Stainless steel.
  3. Exterior Sleeve: Single braided.
  4. Pressure Rating: 200 psig (1380 kPa) WOG and 250 degrees F (121 degrees C).
  5. Joint: As specified for pipe joints.

6. Size: Use pipe sized units.
7. Maximum offset: 3/4 inch (19 mm) on each side of installed center line.
2. Copper Piping:
3.
  1. Acceptable Manufacturers:
    1. Mason Industries, Inc.
    2. Senior Flexonics, Inc.
    3. Proco Products, Inc.
    4. Hyspan Precision Products, Inc.
    5. Twin City Hose, Inc.
    6. Metraflex Company.
    7. Approved equal under provisions of Divisions 0 and 1.
  1. Inner Hose: Bronze
  2. Exterior Sleeve: Braided bronze.
  3. Pressure Rating: 125 psig (862 kPa) WSP and 450 degrees F (232 degrees C).
  4. Joint: As specified for pipe joints.
  5. Size: Use pipe sized units.
  6. Maximum offset: 3/4 inch (19 mm) on each side of installed center line.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

1. Work shall be installed as shown and in accordance with manufacturer's instructions, diagrams and recommendations.
2. Construct spool pieces to exact size of flexible connection for future insertion.

3. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
4. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

### 3.2 PAINTING

#### A. Touching up:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting".
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

### 3.3 MANUFACTURER'S FIELD SERVICES

1. Prepare and start systems under provisions of Divisions 0 and 1.
2. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION





## SECTION 15140

### SUPPORTS AND ANCHORS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Pipe and equipment hangers and supports.
2. Equipment bases and supports.
3. Sleeves and seals.
4. Flashing and sealing equipment and pipe stacks.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Placement of inserts and sleeves in concrete formwork.
2. Placement of equipment roof supports.
3. Placement of roof sleeves, vents, and curbs.

##### 1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1. Supply of roofing equipment supports for placement by this Section.

##### 1.4 RELATED SECTIONS

1. Section 03300 - Cast-In-Place Concrete: Equipment bases.
2. Section 07270 - Firestopping: Joint seals for piping and duct penetration of fire rated assemblies.
3. Section 09900 - Painting.
4. Section 15245 - Vibration Isolation.
5. Section 15260 - Piping Insulation.
6. Section 15280 - Equipment Insulation.

7. Section 15330 - Fire Protection Piping.
8. Section 15410 - Plumbing Piping.
9. Section 15510 - Hydronic Piping.

1.5 CODES AND STANDARDS  
(Latest Edition or Revision)

1. ASME B31.1 - Power Piping.
2. ASME B31.2 - Fuel Gas Piping.
3. ASME B31.9 - Building Services Piping.
4. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
5. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
6. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
7. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
8. NFPA 13 - Installation of Sprinkler Systems.
9. NFPA 14 - Installation of Standpipe and Hose Systems.
10. UL 203 - Pipe Hanger Equipment for Fire Protection Service.
11. ASME B18.10 - Track Bolts & Nuts.
12. ASME Boiler & Pressure Vessel Code Section II "Material Specifications", Parts A, B & C, and Section IX "Welding & Brazing Qualifications".
13. ASTM A 36/A 36M - Specification for Structural Steel.
14. ASTM A 183 - Specification for Carbon Steel Track Bolts & Nuts.
15. ASTM A 780 - Practice for Repair of Damaged Hot-Dipped Galvanized Coatings.

16. ASTM C33 - Specification for Concrete Aggregates.
17. ASTM C 150 - Specification for Portland Cement.
18. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
19. ASTM F 844 - Specification for Washers, Steel Plain (Flat), Unhardened for General Use.
20. AWS D1.1 - Structural Welding Code - Steel.
21. MSS SP-90 - Guidelines on Terminology for Pipe Hangers & Supports.
22. NFPA 70 - National Electrical Code.
23. SSPC-PA 1 - Paint Application Specification No. 1, Shop, Field, & Maintenance Painting.

#### 1.6 PERFORMANCE REQUIREMENTS

1. Design seismic restraint hangers and supports, for piping and equipment.
2. Design and obtain approval from authority with jurisdiction over seismic restraint hangers and supports for piping and equipment.

#### 1.7 SUBMITTALS

1. Government approval is required for submittal with a OGAO designation; submittal having an OFIO≅ designation are for information only. The following shall be submitted in accordance with Section 01330  
SUBMITTAL DESCRIPTIONS:
2. Shop Drawings: Indicate system layout with location and detail of trapeze hangers. Submit shop drawings for each type of hanger and support, indicating dimensions, weights, required clearance, and methods of component assembly.
3. Product Data: Provide manufacturers catalog data including load capacity.
4. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

5. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.
6. Welder's Certificates: Contractor shall sign welders certificates, certifying that welders comply with requirements specified under Qualifications.
7. Pipe Hanger Schedule: Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.

#### 1.8 REGULATORY REQUIREMENTS

1. Conform to applicable codes for support of plumbing and hydronic piping.
2. Supports for Sprinkler Piping: In conformance with NFPA 13.
3. Supports for Standpipes: In conformance with NFPA 14.

#### 1.9 QUALIFICATIONS

1. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code-Steel".
  1. Certify that each welder has satisfactorily passed AWS Qualification tests for welding processes involved and, if pertinent, has undergone recertification.
2. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
3. NFPA Compliance: Comply with NFPA 13 and 14 for hangers and supports used as components of fire protection systems.
4. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
  1. Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.

5. Use operators that are licensed by power-operated tool manufacturers to operate their tools and fasteners.
6. Licensed Engineer: Prepare hanger and support design drawings, and calculations for seismic restraint of piping and equipment. Include seal and signature of Registered Engineer, Licensed in Jurisdiction where project is located, certifying compliance with specifications.

## PART 2 PRODUCTS

### 2.1 PIPE HANGERS AND SUPPORTS

1. Acceptable Manufacturers:
  1. Grinnell Corp.
  2. B-Line Systems, Inc.
  3. Michigan Hanger Co.
  4. Approved Equal under Provisions of Divisions 0 and 1.
2. Fire Protection Piping:
  1. Conform to NFPA 13 and NFPA 14.
  2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
  3. Hangers for Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
  4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
  6. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
  7. Vertical Support: Steel riser clamp.
  8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
3. Plumbing Piping - DWV:
  1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
  3. Hangers for Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
  4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
  6. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
  7. Vertical Support: Steel riser clamp.
  8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
4. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
  2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
  3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
  4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
  5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  6. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
  7. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
  8. Vertical Support: Steel riser clamp.
  9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  10. Floor Support for Hot Pipe Sizes to 4 Inches (102 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 5. Hydronic Piping:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (102 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 2.2 ACCESSORIES

1. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

## 2.3 INSERTS

1. Acceptable Manufacturers:
  1. Grinnell Corp.
  2. B-Line Systems, Inc.
  3. Michigan Hanger Co.
  4. Approved Equal under provisions of Divisions 0 and 1.
2. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.4 FLASHING

1. Metal Flashing: 26 gage (0.6 mm thick) galvanized steel.
2. Metal Counterflashing: 22 gage (0.9 mm thick) galvanized steel.
3. Lead Flashing:
  1. Waterproofing: 5 lb/sq ft (24.5 kg/sq m) sheet lead
  2. Soundproofing: 1 lb/sq ft (5 kg/sq m) sheet lead.
4. Flexible Flashing: 47 mil (1.2 mm) thick sheet butyl or lead as required and compatible with roofing.
5. Caps: Steel, 22 gage (0.9 mm) minimum; 16 gage (1.6 mm) at fire resistant elements.

## 2.5 EQUIPMENT CURBS

1. Acceptable Manufacturers shall be same as that of equipment to be supported.
2. Fabrication: Welded 18 gage (1.3 mm) galvanized steel shell and base, mitered 3 inch (76 mm) cant, [variable step to match roof insulation,] [1-1/2 inch (38 mm) thick insulation,] factory installed wood nailer.



## 2.6 SLEEVES

1. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.3 mm thick) galvanized steel.
2. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.3 mm thick) galvanized steel.
3. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed, refer to Division 7 - THERMAL AND MOISTURE PROTECTION.
4. Sleeves for Round Ductwork: Galvanized steel.
5. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
6. Stuffing or Firestopping Insulation: Glass fiber type, non-combustible. Refer to Division 7 - THERMAL AND MOISTURE PROTECTION.
7. Sealant: refer to Section 07900.

## PART 3 EXECUTION

### 3.1 INSTALLATION

1. Install in accordance with manufacturer's instructions.
2. Specific hanger and support requirements are specified in the section specifying the equipment and systems.
3. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

### 3.2 INSERTS AND ATTACHMENTS

1. Install building attachments within concrete or to structural steel. space attachments within maximum piping span length indicated in MSS SP69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is

placed; fasten inserts to forms. Install reinforcing bars through openings at top of inserts.

2. Provide inserts for placement in concrete formwork. Install concrete inserts in new construction prior to placing concrete.
3. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
4. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (102 mm).
5. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
6. Install power actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by power-actuated tool manufacturer. Install fasteners according to power-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (102 mm) thick.
7. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (102 mm) thick.

### 3.3 PIPE HANGERS AND SUPPORTS

1. Comply with MSS SP-69 and SP-89 for hanger selections, applications and maximum spacing. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (305 mm) of each horizontal elbow.

5. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
6. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
7. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Field fabricated heavy-duty steel trapezes shall be from ASTM A36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
9. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
10. Support riser piping independently of connected horizontal piping.
11. Provide copper plated hangers and supports for copper piping.
12. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units, without disengagement of supported pipe.
13. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in pipe shafts, and suspended ceiling spaces are not considered exposed.
14. Support fire protection systems piping independent of other piping.
15. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.

16. Insulated Piping: Comply with the following installation requirements.
  1. Clamps: Attach clamps, including any spacers, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
  2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation to match adjoining pipe insulation.
  3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees (3.1 rad).

#### 3.4 EQUIPMENT BASES AND SUPPORTS

1. Provide housekeeping pads of concrete, minimum 4 inches (102 mm) thick and extending 6 inches (152 mm) beyond supported equipment. Refer to Section 03300.
2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
3. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
4. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
5. Provide rigid anchors for pipes after vibration isolation components are installed.
6. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

#### 3.5 FLASHING

1. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
2. Flash vent and soil pipes projecting 3 inches (76 mm) minimum above finished roof surface with lead worked 1-inch (25 mm) minimum into hub, 8 inches

(203 mm) minimum clear on sides with 24 x 24 inches (610 x 610 mm) sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash, and seal.

3. Flash floor drains in floors with topping over finished areas with lead, 10 inches (254 mm) clear on sides with minimum 36 x 36 inch (914 x 914 mm) sheet size. Fasten flashing to drain clamp device.
4. Seal all drains watertight to adjacent materials.
5. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
6. Provide curbs for mechanical roof installations 14 inches (350 mm) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
7. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

### 3.6 SLEEVES

1. Set sleeves in position in formwork. Provide reinforcing around sleeves.
2. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
3. Extend sleeves through floors 1 inch (25 mm) above finished floor level, and caulk sleeves.
4. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing and fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
5. Install chrome plated steel escutcheons at finished surfaces.

### 3.7 METAL FABRICATION

1. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.
2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections to that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

### 3.8 ADJUSTING

1. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.9 PAINTING

#### A. Touching Up

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting".
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.10 FIELD QUALITY CONTROL

1. Licensed Engineer's Report: Prepare hanger and support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

### 3.11 HANGER SCHEDULE

<u>PIPE SIZE</u> <u>Inches (mm)</u>	<u>MAX.</u> <u>HANGER SPACING</u> <u>Feet (m)</u>	<u>HANGER ROD</u> <u>DIAMETER</u> <u>Inches (mm)</u>
1/2 to 1-1/4 (18 to 32)	6.5 (2.0)	3/8 (10)
1-1/2 to 2 (38 to 51)	10 (3.0)	3/8 (10)
2-1/2 to 3 (64 to 76)	10 (3.0)	1/2 (13)
4 to 6 (102 to 152)	10 (3.0)	5/8 (16)
8 to 12 (203 to 305)	14 (4.3)	7/8 (22)
14 and Over (356 and Over)	20 (6.1)	1 (25)
PVC (All Sizes)	6 (1.8)	3/8 (10)
C.I. Bell and Spigot(or No-Hub) and at Joints	5 (1.5 )	3/8 (10)

END OF SECTION





## SECTION 15170

### MOTORS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Single phase electric motors.
2. Three phase electric motors.

##### 1.2 RELATED SECTIONS

1. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

##### 1.3 CODES AND STANDARDS (Latest Edition or Revision)

1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
3. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
4. NEMA MG 1 - Motors and Generators.
5. NFPA 70 - National Electrical Code.
6. UL 1004 - Electric Motors.

##### 1.4 SUBMITTALS

1. Government approval is required for submittal with a OGAO designation; submittal having an OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
2. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

3. Test Reports: Indicate test results verifying nominal efficiency and power factor for motors larger than 1/2 HP (0.4 KW).
4. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

#### 1.5 OPERATION AND MAINTENANCE DATA

1. Submit under provisions of Section 15010.
2. Operation Data: Include instructions for safe operating procedures.
3. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

#### 1.6 QUALIFICATIONS

1. Manufacturer: Company specializing in manufacture of electric motors for mechanical use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
2. Motors and components shall comply with NFPA 70 "National Electrical Code", and shall be NRTL Listed as defined in "National Electrical Code," Article 100. Comply with MENA MG1, "Motors and Generators".
3. Motors and components shall comply with UL 1004, "Motors, Electric."

#### 1.7 REGULATORY REQUIREMENTS

1. Conform to applicable electrical code, NFPA 70, and local energy code.
2. Provide certificate of compliance from authority having jurisdiction indicating approval of high efficiency motors.
3. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
2. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.9 WARRANTY

1. Provide five year warranty under provisions of Divisions 0 and 1.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

1. Baldor Electric Co.
2. Eaton Corp.
3. General Electric Co.
4. MagneTek Inc.
5. A. O. Smith Co.
6. Westinghouse Motor Co.
7. Emerson Electric Co.
8. Approved equal under provisions of Divisions 0 and 1.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

1. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.
2. Electrical Service:
  1. Refer to Section 16180 for required electrical characteristics and connections. See Mechanical Schedules for specific motor voltage/phase/Hz.

3. Type

1. Open drip-proof except where specifically noted otherwise.
2. Motors: Design for continuous operation in 105 degrees F (40 degrees C) environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Motors with frame sizes 254T and larger: Energy Efficient Type.
4. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.
5. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
6. Wiring Terminations:
  1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
  2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

2.3 SINGLE PHASE POWER - SPLIT PHASE MOTORS

1. Starting Torque: Less than 150 percent of full load torque.
2. Starting Current: Up to seven times full load current.
3. Breakdown Torque: Approximately 200 percent of full load torque.
4. Drip-proof Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

5. Enclosed Motors: Class A (120 degrees F (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated ball bearings.

#### 2.4 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

1. Starting Torque: Exceeding one fourth of full load torque.
2. Starting Current: Up to six times full load current.
3. Multiple Speed: Through tapped windings.
4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

#### 2.5 SINGLE PHASE POWER - CAPACITOR START MOTORS

1. Starting Torque: Three times full load torque.
2. Starting Current: Less than five times full load current.
3. Pull-up Torque: Up to 350 percent of full load torque.
4. Breakdown Torque: Approximately 250 percent of full load torque.
5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6. Drip-proof Enclosure: Class A (120 degrees F (50 degrees C) temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
7. Enclosed Motors: Class A (120 degrees F) (50 degrees C) temperature rise) insulation, minimum 1.15 Service Factor, prelubricated ball bearings.

#### 2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

1. Starting Torque: Between 1 and 1-1/2 times full load torque.

2. Starting Current: Six times full load current.
3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
5. Insulation System: NEMA Class B or better.
6. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 16481 - Enclosed Motor Controllers.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: To NEMA MG 1.
11. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
12. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
13. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

14. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

## PART 3 EXECUTION

### 3.1 APPLICATION

1. Single phase motors for shaft mounted fans, oil burners, centrifugal pumps: Split phase type.
2. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
3. Single phase motors for fans, pumps, blowers, air compressors: Capacitor start type.
4. Single phase motors for fans, blowers, pumps: Capacitor start, capacitor run type.
5. Motors located in exterior locations, explosion proof environments: Totally enclosed type.
6. Motors located in outdoors: Totally enclosed weatherproof epoxy-sealed type.

### 3.2 INSTALLATION

1. Install in accordance with manufacturer's published instructions.
2. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
3. Check line voltage and phase and ensure agreement with nameplate.
4. Mount direct connected motors securely in accurate alignment.
5. Mount belt drive motors using adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer's recommendations.

### 3.3 COMMISSIONING

1. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.
2. Report any unusual conditions, and correct deficiencies of field-installed units.

### 3.4 NEMA OPEN MOTOR SERVICE FACTOR SCHEDULE

<u>HP</u>	<u>3600 RPM</u>	<u>1800 RPM</u>	<u>1200 RPM</u>	<u>900 RPM</u>	<u>KW</u>
1/6-1/3	1.35	1.35	1.35	1.35	(0.12-0.25)
1/2	1.25	1.25	1.25	1.15	(0.37)
3/4	1.25	1.25	1.15	1.15	(0.56)
1	1.25	1.15	1.15	1.15	(0.75)
1.5-150	1.15	1.15	1.15	1.15	(1.12-111.85)

### 3.5 PERFORMANCE SCHEDULE: THREE PHASE - ENERGY EFFICIENT, OPEN DRIP-PROOF

<u>HP</u>	<u>RPM (Syn)</u>	<u>NEMA Frame</u>	<u>Minimum Percent Efficiency</u>	<u>Minimum Percent Power Factor</u>	<u>(KW)</u>
1	1200	145T	81	72	(0.75)
1-1/2	1200	182T	83	73	(1.12)
2	1200	184T	85	75	(1.50)
3	1200	213T	86	60	(2.24)
5	1200	215T	87	65	(3.73)
7-1/2	1200	254T	89	73	(5.60)
10	1200	256T	89	74	(7.46)
15	1200	284T	90	77	(11.19)
20	1200	286T	90	78	(14.91)
25	1200	324T	91	74	(18.64)
30	1200	326T	91	78	(22.37)
40	1200	364T	93	77	
(29.83)					
50	1200	365T	93	79	
(37.29)					
60	1200	404T	93	82	
(44.74)					



75 (55.93)	1200	405T	93	80
100 (74.57)	1200	444T	93	80
125 (93.21)	1200	444T	93	84
1 (0.75)	1800	143T	82	84
1-1/2 (1.12)	1800	145T	84	85
2 (1.50)	1800	145T	84	85
3 (2.24)	1800	182T	86	86
5 (3.73)	1800	184T	87	87
7-1/2 (5.60)	1800	213T	88	86
10 (7.46)	1800	215T	89	85
15 (11.19)	1800	256T	91	85
20 (14.91)	1800	256T	91	86
25 (18.64)	1800	284T	91	85
30 (22.37)	1800	286T	92	88
40 (29.83)	1800	324T	92	83
50 (37.29)	1800	326T	93	85
60 (44.74)	1800	364T	93	88
75 (55.93)	1800	365T	93	88
100 (74.57)	1800	404T	93	83
125 (93.21)	1800	405T	93	86
150 (111.85)	1800	444T	93	85
200 (149.14)	1800	445T	94	85

1-1/2 (1.12)	3600	143T	82	85
2 (1.50)	3600	145T	82	87
3 (2.24)	3600	145T	84	85
5 (3.73)	3600	182T	85	86
7-1/2 (5.60)	3600	184T	86	88
10 (7.46)	3600	213T	87	86
15 (11.19)	3600	215T	89	89
20 (14.91)	3600	254T	90	89
25 (18.64)	3600	256T	90	92
30 (22.37)	3600	284T	91	91
40 (29.83)	3600	286T	92	92
50 (37.29)	3600	324T	93	89
60 (44.74)	3600	326T	93	91
75 (55.93)	3600	364T	93	88
100 (74.57)	3600	365T	92	88

3.6 PERFORMANCE SCHEDULE: THREE PHASE-ENERGY EFFICIENT,  
TOTALLY ENCLOSED, FAN COOLED

<u>HP</u> <u>(KW)</u>	<u>RPM (Syn)</u>	<u>NEMA</u> <u>Frame</u>	<u>Minimum</u> <u>Percent</u> <u>Efficiency</u>	<u>Minimum</u> <u>Percent</u> <u>Power</u> <u>Factor</u>
1 (0.75)	1200	145T	81	72
1-1/2 (1.12)	1200	182T	83	65

2 (1.50)	1200	184T	85	68
3 (2.24)	1200	213T	85	63
5 (3.73)	1200	215T	86	66
7-1/2 (5.60)	1200	254T	89	68
10 (7.46)	1200	256T	89	75
15 (11.19)	1200	284T	90	72
20 (14.91)	1200	286T	90	76
25 (18.64)	1200	324T	90	71
30 (22.37)	1200	326T	91	79
40 (29.83)	1200	364T	92	78
50 (37.29)	1200	365T	92	81
60 (44.74)	1200	404T	92	83
75 (55.93)	1200	405T	92	80
100 (74.57)	1200	444T	93	83
125 (93.21)	1200	445T	93	85
1 (0.75)	1800	143T	82	84
1-1/2 (1.1)	1800	145T	84	85
2 (1.5)	1800	145T	84	85
3 (2.24)	1800	182T	87	83
5 (3.73)	1800	184T	88	83
7-1/2 (5.60)	1800	213T	89	85
10 (7.46)	1800	215T	90	84

15 (11.19)	1800	254T	91	86
20 (14.91)	1800	256T	91	85
25 (18.64)	1800	284T	92	84
30 (22.37)	1800	286T	93	86
40 (29.83)	1800	324T	93	83
50 (37.29)	1800	326T	93	85
60 (44.74)	1800	364T	93	87
75 (55.93)	1800	365T	93	87
100 (74.57)	1800	405T	94	86
125 (93.21)	1800	444T	94	87
150 (111.85)	1800	445T	94	88
200 (149.14)	1800	447T	95	87
1-1/2 (1.12)	3600	143T	82	85
2 (1.50)	3600	145T	82	87
3 (2.24)	3600	182T	82	87
5 (3.73)	3600	184T	85	88
7-1/2 (5.60)	3600	213T	86	86
10 (7.46)	3600	215T	86	86
15 (11.19)	3600	254T	88	91
20 (14.91)	3600	256T	89	89
25 (18.64)	3600	284T	90	92
30 (22.37)	3600	286T	91	92

40	3600	324T	91	91
(29.83)				
50	3600	326T	90	92
(37.29)				
60	3600	364T	91	93
(44.74)				
75	3600	365T	91	91
(55.93)				
100	3600	405T	92	92
(74.57)				

END OF SECTION



## SECTION 15190

### MECHANICAL IDENTIFICATION

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Nameplates.
2. Tags.
3. Pipe Markers.

##### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION (NOT APPLICABLE)

##### 1.3 RELATED SECTIONS

1. Section 09900 - Painting: Identification painting.

##### 1.4 CODES AND STANDARDS (Latest Edition or Revision)

1. ASME/ANSI A13.1 - Scheme for the Identification of Piping Systems.

##### 1.5 SUBMITTALS

1. Government approval is required for submittal with a OGAO designation; submittal having an OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
2. Submit list of wording, symbols, letter size, letter style and color coding required for each identification material and device.
3. Valve Schedule: Submit valve schedules for each piping system. Reproduce on Standard size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Furnish extra copies (in addition to mounted copies) for Maintenance Manuals as specified in Section 15010.

4. Product Data: Provide manufacturers catalog literature for each product required.
5. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

#### 1.6 PROJECT RECORD DOCUMENTS

1. Submit under provisions of Section 15010.
2. Record actual locations of tagged valves.

#### 1.7 QUALIFICATIONS

1. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identifying devices.

#### 1.8 SEQUENCING AND SCHEDULING

1. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

### PART 2 PRODUCTS

#### 2.1 NAMEPLATES

1. Acceptable Manufacturers:
  1. Seton Co.
  2. Brady USA, Inc.
  3. Almetek Industries, Inc.
  4. Approved equal under provisions of Divisions 0 and 1.
2. Description: Laminated three-layer plastic with engraved white letters on dark contrasting background color.



## 2.2 TAGS

1. Acceptable Manufacturers:
  1. Seton Co.
  2. Brady USA, Inc.
  3. Almetek Industries, Inc.
  4. Approved equal under provisions of Divisions 0 and 1.
2. Metal Tags: Brass or Aluminum with 1/4" (6 mm) (minimum) stamped letters; tag size minimum 1-1/2 inch (38 mm) diameter with smooth edges.
3. Chart: Typewritten letter size list in anodized aluminum frame.

## 2.3 PIPE MARKERS

1. Acceptable Manufacturers:
  1. Seton Co.
  2. Brady USA, Inc.
  3. Almetek Industries, Inc.
  4. Approved equal under provisions of Divisions 0 and 1.
2. Color: Conform to ASME/ANSI A13.1.
3. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
4. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
5. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (152 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

## 2.4 CEILING TACKS

1. Acceptable Manufacturers:
  1. Seton Co.
  2. Brady USA, Inc.
  3. Almetek Industries, Inc.
  4. Approved equal under provisions of Divisions 0 and 1.
2. Description: Steel with 3/4 inch (19 mm) diameter color coded head.
3. Color code as follows:
  1. Yellow - HVAC equipment
  2. Red - Fire dampers/smoke dampers
  3. Green - Plumbing valves
  4. Blue - Heating/cooling valves

## PART 3 EXECUTION

### 3.1 PREPARATION

1. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 INSTALLATION

1. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
2. Install tags with corrosion resistant chain.
3. Install plastic pipe markers in accordance with manufacturer's instructions.
4. Install plastic tape pipe markers completely around pipe in accordance with manufacturer's instructions.

5. Install underground plastic pipe markers 6 to 8 inches (152 to 203 mm) below finished grade, directly above buried pipe.
6. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
7. Identify control panels and major control components outside panels with plastic nameplates.
8. Identify thermostats relating to terminal boxes or valves with nameplates.
9. Identify valves in main and branch piping with tags.
10. Identify air terminal units and radiator valves with numbered tags.
11. Tag automatic controls, instruments, and relays. Key to control schematic.
12. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6.1 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
13. Identify ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
14. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

### 3.3 LABELING AND IDENTIFYING

1. Plastic markers with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
  1. Fasten markers on pipes smaller than 6 inches (152 mm) by one of following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
  2. Adhesive lap joint in pipe marker overlap.
  3. Laminated or bonded application of pipe marker to pipe (or insulation).
  4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch (19 mm) wide, lapped 1-1/2 inches (38 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.
2. Fasten markers on pipes 6 inches (152 mm) and larger by one of following methods:
    1. Laminated or bonded application of pipe marker to pipe (or insulation).
    2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inches (38 mm) wide, lapped 3 inches (76 mm) minimum at both ends of pipe marker, and covering full circumference of pipe.
    3. Strapped to pipe (or insulation) with manufacturer's standard stainless steel bands.
  2. Locate pipe markers and color bands as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
    1. Near each valve and control device.
    2. Near each branch connection, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
    3. Near penetrations through walls, floors, ceilings, or enter non-accessible enclosures.
    4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
  6. Space at a maximum of 50-feet (15.2 m) intervals along each run. Reduce intervals to 25 feet (7.6 m) in congested areas of piping and equipment.
  7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
3. Valve Tags: Install valve tag on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shut-off valves, faucets, convenience and lawn-watering hose bibbs, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.
    1. Install mounted valve schedule in each major equipment room.
  4. Equipment Signs: Install engraved plastic laminate signs or equipment markers on or near each major item of mechanical equipment.
    1. Provide signs for following general categories of equipment:
      2.
        1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
        2. Meters, gages, thermometers, and similar units.
        3. Fuel-burning units including boilers, and heaters.
        4. Pumps, compressors, and similar motor-driven units.
        5. Coils, and similar equipment.
        6. Fans, blowers, primary balancing dampers, and mixing boxes.
        7. Packaged HVAC central-station and zone-type units.

8. Tanks and pressure vessels.
9. Strainers, filters, water treatment systems, and similar equipment.
3. Lettering Size: Minimum 1/4 inch (6 mm) for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2 inch (13 mm) for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
4. Terms on Signs: In addition to name of identified unit distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
5. Plasticized Tags: Install within concealed space to reduce amount of text in exposed sign (outside concealment), where equipment to be identified is concealed above acoustical ceiling or similar concealment.
  1. Identify operational valves and similar minor equipment items located in unoccupied spaces (including machine rooms) by installing plasticized tags.
6. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers and arrows showing duct system service and direction of flow.
  1. Location: In each space where ducts are exposed or concealed by removable ceiling system. Locate signs near points where ducts enter into concealed space and at maximum intervals of 50 feet (15.2 m).

### 3.4 ADJUSTING AND CLEANING

1. Relocate mechanical identification materials and devices which have become visually blocked by work of this Division or other Divisions.
2. Clean face of identification devices, and glass frames of valve charts.

END OF SECTION





SECTION 15245

SEISMIC PROTECTION FOR  
MECHANICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded, and Seamless
ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 500	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(1994) Carbon and Alloy Steel Nuts
ASTM A 603	(1994) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653 M	(1996) Steel Sheet, Zinc Coated Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	(1990) Strength of Anchors in Concrete and Masonry Elements
ASTM E 580	(1991) Application of Ceiling

Suspension Systems for  
Acoustical Tile and Lay-In  
Panels in Areas Requiring  
Seismic Restraint

- B. Mechanical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Boilers  
Water Heaters  
Expansion Air Separator Tanks  
Water Chiller Units  
Control Panels  
Pumps with Motors  
Motor Control Centers  
Water and Gas Piping  
Air Handling Units  
Ducts  
Unit Heaters  
Exhaust and Return Fans

1.2 Mechanical/Electrical Systems

- A. The following mechanical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:  
All Piping Inside the Building in Accordance With This Specification  
All Water Supply Systems  
Storm and Sanitary Sewer Systems

1.3 Equipment and Systems

- A. The bracing for the following mechanical equipment and systems shall be developed by the Contractor in accordance with the requirements of this specification.

1.4 Exclusion

- A. Seismic protection of piping for fire protection systems shall be installed as specified in Sections 15330 WET PIPE SPRINKLER SYSTEM, FIRE SPRINKLER SYSTEM, FIRE PROTECTION.

1.5 Pipes and Ducts Requiring No Special Seismic Restraints

- A. Seismic restraints may be omitted from the following installation:

- a. Gas piping less than 25mm (1 inch) 1 inch inside diameter.
- b. Piping in boiler and mechanical equipment rooms less than 32 mm (1-1/4 inches) 1-1/4 inches inside diameter.
- c. All other piping less than 38mm (1-1/2 inches ) 1-1.2 inches inside diameter.
- d. Rectangular air handling ducts less than 0.37 square meters (4 square feet) 4 square feet in cross sectional area.
- e. Round air handling ducts less than 457 mm (18 inches) 18 inches in diameter.
- f. Piping suspended by individual hangers 300 mm 12 inches or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.
- g. Ducts suspended by hangers 300 mm 12 inches or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below. In exemption f. and g. all hangers shall meet the length requirements. If the length requirements is exceeded by one hanger in the run, the entire run shall be braced.

#### 1.5 All Other Interior Piping and Ducts

- A. Interior piping and ducts not covered by paragraphs Exclusion or Pipes and ducts Requiring No special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

#### 1.6 Submittal

- A. Government approval is required for submittal with a OGAO designation; submittal having an OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

- B. Bracing and Coupling, Miscellaneous Equipment.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

- C. Bracing and Coupling, Flexible Couplings or Joints, Resilient Vibration Isolation Devices and Miscellaneous Equipment.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the

items listed. Submittal shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

## PART 2 PRODUCTS

### 2.1 Material and Equipment

- A. Materials and equipment shall conform to the requirements specified below:

### 2.2 Bolts and Nuts

- A. Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153.

### 2.3 Sway Bracing

- A. Material used for members listed in this section shall be structural steel conforming with the following:

- a. Plates, rods, and rolled shaped, ASTM A 36/A 36M.
- b. Wire rope, ASTM A 603.
- c. Tubes, ASTM a 500, Grade B.
- d. Pipes, ASTM A 53, Type E or S, Grade B.
- e. Light gauge angles, less than 6mm 1/4 inch thickness, ASTM A 653/A 653M.

### 2.4 Flexible Couplings

- A. Flexible couplings shall have same pressure and temperature ratings as adjoining pipe specified in section 15510.

- a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.
- b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one

steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be high-strength type as specified above.

## PART 3 EXECUTION

### 3.1 Bracing and Coupling

- A. Bracing and coupling shall conform to the arrangements shown. Provisions of this paragraph apply to all piping within a 1.5 m 5 floor line around outside of the building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 13 mm (2 inch) 1.2 inch bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

### 3.2 Building Drift

- A. Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 meters per meter feet per foot of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer=s selection table.

### 3.3 Flexible Coupling or Joints

#### A. Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 90 mm (3-1/2 inches) 3-2 inches in diameter. Flexible couplings or joints shall be braced laterally without interfering with the ction of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these

requirements.

B. Underground Piping

Underground piping shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 76 mm (3 inches) of relative movement between the pipe and the building in any direction. Additional flexible couplings shall be provided where shown on the drawings.

3.4 Pipe Sleeves

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.

3.5 Spreaders

- A. Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity when ever pipe or insulated pipe surfaces are less than 100 mm 4 inches apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pip protection shields in accordance with the requirement of Section

3.6 Anchor Bolts

- A. Cast-In-Place: Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. Two nuts shall be provided on each bolt. Anchor bolts shall conform to the following tabulation for the various equipment weights an specified seismic zone or the manufacturer=s installation recommendations, whichever is the most stringent, unless otherwise shown on the drawings. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

B. Minimum Bolt Sizes, Cast-In-Place Anchor Bolts

Maximum Equipment	Minimum Bolt Sizes (mm)*
-------------------	--------------------------

Weight (Kg)	Zone 3
225	13
450	13
2250	13
4500	13
9000	13
13500	13
22500	16
45000	**

Maximum Equipment                      Minimum Bolt Sizes (Inches)\*

Weight (Lbs)	Zone 3
500	2
1,000	2
5,000	2
10,000	2
20,000	2
30,000	2
50,000	5/8
100,000	**

\*Bases on flouir bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM a 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

\*\*Equipment weighting more than 22,500kg 50,000 lb in Zones 3 and 4 shall have at least six bolts per item.

C. Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required in paragraph Minimum Bolt Sized, Cast-In-Place Anchor Bolts. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer=s recommendations. Than allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

D. General Testing

Expansion and chemically bonded anchors shall be tested in

place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

E. Torque Wrench Testing

Torque wrench testing shall be done on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque test are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 9 mm 3/8 inch sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

F. Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than three per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.7 Resilient Vibration Isolation Devices

A. Selection of anchor bolts for vibration isolation devices



and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS except that an equipment weight equal to five times the actual equipment weight shall be used.

B. Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on all floor- or slab-mounted equipment. These snubbers shall provide 6 mm 0.25 inches free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.8 Sway Braces for Piping

A. Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

B. Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below as modified for each seismic zone. All runs shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

C. Maximum Span for Transverse Sway Braces in Seismic Zone 4

Pipe Diameter	Std. Wgt. Steel Pipe - 405		Ex. Strong Steel Pipe - 80S		Copper Tube Type L	
(mm)	*L(m)	**F(kN)	*L(m)	**F(kN)	*L(m)	**F(kN)
25	6.7	0.03	6.7	0.4	3.4	0.08
40	7.6	0.06	7.9	0.8	3.7	0.16
50	8.8	1.0	9.1	1.3	4.3	0.30
65	9.8	1.7	10.0	2.1	4.8	0.50
80	10.4	2.5	10.7	3.2	5.2	0.70
90	11.0	3.3	11.6	4.1	5.5	1.0
100	11.9	4.3	12.2	5.3	5.8	1.3

125	12.5	6.4	13.4	8.5	6.1	2.1
150	13.7	9.4	14.0	12.2	6.7	3.3
200	14.9	16.6	16.5	22.9	7.9	6.9
250	16.5	27.1	18.0	34.1	8.5	11.7
300	17.7	38.1	18.6	46.0	9.4	17.6

Pipe Diameter	Std. Wgt. Steel Pipe - 40S		Ex. Strong Steel Pipe - 80S		Copper Tube Type L	
(in.)	*L(ft.)	**F(lbs)	*L(ft.)	** (lbs)	*L(ft)	**F(lbs)
1	22	70	22	80	11	17
1-1/2	25	140	26	180	12	35
2	29	220	30	290	14	70
2-1/2	32	380	33	460	15	110
3	34	550	35	710	17	150
3-1/2	36	730	38	930	18	220
4	39	960	40	1,200	19	300
5	41	1,440	44	1,900	20	470
6	45	2,120	46	2,750	22	730
8	49	3,740	54	5,150	26	1,550
10	54	6,080	59	7,670	28	2,630
12	58	8,560	61	10,350	31	3,950

NOTE: Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gauge 2 x 2 x 16 gauge and one diagonal angle of the same size.

#### D. Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 12m 40 foot intervals except when the location of sway braces is shown on the drawings for the particular piping system. All runs shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

#### E. Vertical Runs

Vertical runs of piping shall be braces at not more than 3 m 10 floor vertical intervals. For tubing, bracing shall be provide d at no more than 1.2 m 34 floor spacing. Vertical braces shall be above the center of gravity of the span being braced. All sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

#### F. Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

G. Maximum Length for Anchor Braces

Type	Size (millimeters)	Maximum Length* (meters)	Allowable Loads* (kilonewtons)
Angles	38 x 38 x 6	1.5	25.5
	50 x 50 x 6	2.0	34.5
	64 x 38 x 6	2.5	43.5
	75 x 64 x 6	2.5	48.0
	75 x 75 x 6	3.0	53.0
Rods	91	1.0	16.5
	22	1.0	22.0
Flat Bars	38 x 6	0.4	14.0
	50 x 6	0.4	18.0
	50 x 10	0.5	28.5
Pipes	25	2.0	18.0
	32	2.8	24.5
	40	3.2	29.5
	50	4.0	39.5

Type	Size (inches)	Maximum Length* (Feet/Inches)	Allowable Loads* (kips)
Angles	1-1/2 x 1-1/2 x 1/4	4-10	5.7
	2 x 2 x 1/4	6-6	7.8
	2-1/2 x 1-1/2 x 1/4	8-0	9.8
	3 x 2-1/2 x 1/4	8-10	10.8
	3 x 3 x 1/4	9-10	11.9
Rods	3/4	3-1	3.7
	7/8	3-8	5.0
Flat Bars	1-1/2 x 1/4	1-2	3.1
	2 x 1/4	1-2	4.1
	2 x 3/8	1-9	6.2
Pipes (40S)	1	7-0	4.1
	1-1/4	9-0	5.5
	1-1/2	10-4	6.6

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intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

B. FLOOR OR PAD MOUNTED EQUIPMENT

1. SHEAR RESISTANCE

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

2. OVERTURNING RESISTANCE

The ratio of the height of the equipment (measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. IF this ratio is greater than 2.22 the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.11 MISCELLANEOUS EQUIPMENT

A. RIGIDLY MOUNTED EQUIPMENT

The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of 1.13 times the operating weight of the equipment at the vertical center of gravity of the equipment.

END OF SECTION



SECTION 15260

PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Piping insulation.
2. Jackets and accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Section 15410 - Plumbing Piping: Placement of hangers and hanger inserts.
2. Section 15510 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 RELATED SECTIONS

1. Section 09900 - Painting: Painting insulation jacket.
2. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS

(Latest Edition or Revision)

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
3. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
4. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
5. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
6. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

7. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
10. ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
11. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
12. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
13. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
14. ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
15. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
16. ASTM E84 - Surface Burning Characteristics of Building Materials.
17. ASTM E96 - Water Vapor Transmission of Materials.
18. NFPA 255 - Surface Burning Characteristics of Building Materials.
19. UL 723 - Surface Burning Characteristics of Building Materials.
20. ASHRAE 90.1 - Energy Conservation in New Building Design.
21. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.
22. ASTM C 553 - Specification for Mineral Fiber Blanket & Felt Insulation.
23. ASTM C 612 - Specification for Mineral Fiber Block & Board Thermal Insulation.



24. ASTM D 579 - Specification for Greige Woven Glass Fabrics.
25. NFPA 90A - Air Conditioning & Ventilating Systems.
26. NFPA 90B - Warm Air Heating & Air Conditioning Systems.
27. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.
28. NFPA 220 - Standard on Types of Building Construction.

#### 1.5 SUBMITTALS:

1. Government approval is required for submittal with a OGAO designation; submittal having an OFIOO desination are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
2. Product Data: Provide product description, list of materials, k-value, and thickness for each service, and locations.
3. Material Certificates: Submit material certificates, signed by the manufacturers, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.
4. Test Reports: Submit material test reports prepared by a qualified independent testing laboratory. Certify that insulation meets specified requirements.
5. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

#### 1.6 QUALITY ASSURANCE

1. Fire Performance Characteristics: Conform to the following characteristics for insulation facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

2. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

#### 1.7 QUALIFICATIONS

1. Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect, and handle products to site under provisions of Divisions 0 and 1.
2. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
3. Store insulation in original wrapping and protect from weather and construction traffic.
4. Protect insulation against dirt, water, chemical, and mechanical damage.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
2. Maintain temperature during and after installation for minimum period of 24 hours.

### 1.10 SEQUENCING AND SCHEDULING

1. Schedule insulation application after testing of piping systems.
2. Schedule insulation application after installation and testing of heat trace tape.

## PART 2 PRODUCTS

### 2.1 GLASS FIBER

1. Acceptable Manufacturers:
  1. Owens-Corning.
  2. Certainteed Corp.
  3. Manville/Schuller.
  4. Knauf Fiber Glass.
  5. Approved Equal under provisions of Divisions 0 and 1.
2. Insulation: Shall meet requirements of ASTM C547, and shall be rigid molded and noncombustible.
  1. 'K' ('ksi') value : ASTM C335, 0.24 at 75 degrees F (0.035 at 24 degrees C).
  2. Minimum Service Temperature: -20 degrees F (-28.9 degrees C).
  3. Maximum Service Temperature: 300 degrees F (150 degrees C).
  4. Maximum Moisture Absorption: 0.2 percent by volume.
3. Vapor Barrier Jacket
  1. Jacket shall meet requirements of ASTM C921. White kraft paper shall be reinforced with glass fiber yarn and bonded to aluminized film.
  2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.

3. Secure with self sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.
4. Tie Wire: 18 gage (1.2 mm) stainless steel with twisted ends on maximum 12 inch (305 mm) centers.
5. Vapor Barrier Lap Adhesive
  1. Acceptable Manufacturers:
    1. Halstead Industries, Inc.
    2. Hardcast, Inc.
    3. Loctite Corp.
    4. Approved Equal under provisions of Divisions 0 and 1.
  2. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.
6. Insulating Cement/Mastic
  1. Acceptable Manufacturers:
    1. Approved under provisions of Divisions 0 and 1.
  2. Cement/Mastic shall meet requirements of ASTM C195, with hydraulic setting on mineral wool.
7. Fibrous Glass Fabric
  1. Acceptable Manufacturers:
    1. Approved under provisions of Divisions 0 and 1.
  2. Cloth shall be untreated; 9 oz/sq yd (305 g/sq m) weight.
  3. Blanket shall be 1.0 lb/cu ft (16 kg/cu m) density.

8. Indoor Vapor Barrier Finish

1. Acceptable Manufacturers:

1. Approved under provisions of Divisions 0 and 1.
2. Vinyl emulsion type acrylic shall be compatible with insulation used, and shall have white color.

9. Outdoor Vapor Barrier Mastic

1. Acceptable Manufacturers:

1. Approved under provisions of Divisions 0 and 1.
2. Mastic shall be vinyl emulsion type acrylic, compatible with insulation used, and shall have white color.

10. Insulating Cement

1. Acceptable Manufacturers:

1. Approved under provisions of Divisions 0 and 1.
2. Cement shall meet requirements of ASTM C449.

2.2 CELLULAR GLASS

1. Acceptable Manufacturers:

1. Pittsburgh Corning Corp.
  2. Approved Equal under provisions of Divisions 0 and 1.
2. Insulation shall meet requirements of ASTM C552.
1. 'K' ('ksi') value: 0.40 at 75 degrees F (0.058 at 24 degrees C).
  2. Maximum Water Vapor Transmission: 0.1 perm. Inches.

## 2.3 CELLULAR FOAM

### 1. Acceptable Manufacturers:

1. Armstrong World Industries, Inc.
2. Halstead Industrial Products.
3. Rubatex Corp.
4. Approved Equal under provisions of Divisions 0 and 1.

### 2. Insulation shall meet requirements of ASTM C534, and shall be flexible, cellular elastomeric, molded or sheet.

1. 'K' ('ksi') Value: ASTM C177 or C518; 0.27 at 75 degrees F (0.27 at 24 degrees C).
2. Minimum Service Temperature: -40 degrees F ( - 40 degrees C).
3. Maximum Service Temperature: 220 degrees F (104 degrees C).
4. Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
5. Moisture Vapor Transmission: ASTM E96; 0.17 perm inches.
6. Maximum Flame Spread: ASTM E84; 25.
7. Maximum Smoke Developed: ASTM E84; 50.
8. Connection: Waterproof vapor barrier adhesive.

### 3. Elastomeric Foam Adhesive

#### 1. Acceptable Manufacturers:

1. Approved under provisions of Divisions 0 and 1.
2. Adhesive shall be air dried, contact type, and shall be compatible with insulation used.

## 2.4 JACKETS

### 1. PVC Plastic

1. Acceptable Manufacturers:
  1. Approved under provisions of Divisions 0 and 1.
2. Jacket shall meet requirements of ASTM C921, and shall have one piece molded type fitting covers and sheet material, with off white color.
  1. Minimum Service Temperature: -40 degrees F (-40 degrees C).
  2. Maximum Service Temperature: 150 degrees F (66 degrees C).
  3. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
  4. Maximum Flame Spread: ASTM E84; 25.
  5. Maximum Smoke Developed: ASTM E84; 50.
  6. Thickness: 30 mil (0.76 mm).
  7. Connections: Brush on welding adhesive.

### 3. Covering Adhesive Mastic

1. Acceptable Manufacturers:
  - (1) Approved under provisions of Divisions 0 and 1.
2. Mastic shall be compatible with insulation used.

### 2. ABS Plastic

1. Acceptable Manufacturers:
  1. Approved under provisions of Divisions 0 and 1.
1. Jacket shall have one piece molded type fitting covers and sheet material, and shall have off white color.

2. Minimum Service Temperature: -40 degrees F (-40 degrees C).
  3. Maximum Service Temperature of 180 degrees F (82 degrees C).
  4. Moisture Vapor Transmission: ASTM E96; 0.012 perm inches.
  5. Thickness: 30 mil (0.76 mm).
  6. Connections: Brush on welding adhesive.
3. Canvas Jacket shall be UL listed.
1. Fabric shall meet requirements of ASTM C921, and shall be 6 oz/sq yd (220 g/sq m), plain weave cotton, treated with dilute fire retardant lagging adhesive.
  2. Lagging Adhesive
    1. Acceptable Manufacturers:
      - (1) Approved under provisions of Divisions 0 and 1.
    2. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.
4. Aluminum Jacket shall meet requirements of ASTM B209.
1. Thickness: 0.025 inch (0.064 mm) sheet.
  2. Finish: Embossed.
  3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
  4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
  5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
5. Stainless Steel Jacket shall be Type 304 stainless steel.



1. Thickness: 0.016 inch (0.40 mm).
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

1. Verify that piping has been tested before applying insulation materials.
2. Verify that surfaces are clean, foreign material removed, and dry.

#### 3.2 PREPARATION

1. Surface Preparation:
  1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.
2. Mixing:
  1. Mix insulating cements with clean potable water.
  2. Mix insulating cements contacting stainless steel surfaces with demineralized water.
  3. Follow cement manufacturer's printed instructions for mixing and portions.

#### 3.3 INSTALLATION

1. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical systems. Install materials in accordance with manufacturer's instructions.
2. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation of jacket in either the wet or dry state.
3. Install vapor barriers on insulated equipment having surface operating temperatures below 60 deg F (16 deg C).

4. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.
5. Install insulation with smooth, straight, and even surfaces.
6. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier. On exposed piping, locate insulation, and cover seams in least visible locations.
7. Finish and seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.
8. Seal Ends: Except for flexible elastomeric cellular foam insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular foam insulation square and seal with adhesive.
9. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.
10. Keep insulation materials dry during application and finishing.
11. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.
  1. Flexible connectors.
  2. Vibration control devices.
  3. Fire protection piping systems.
  4. Sanitary drainage and vent piping.
  5. Drainage piping located in crawl spaces, unless indicated otherwise.
  6. Below grade piping.
  7. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
  8. Piping specialties including air chambers, unions, strainers, check valves, and flow regulators.

12. Tightly butt longitudinal seams and end joints. Bond with adhesive.
13. Stagger joints on double layers of insulation.
14. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.
15. Apply insulation with a minimum number of joints.
16. Apply insulation with integral jackets as follows:
  1. Pull jacket tight and smooth.
  2. Cover circumferential joints with butt strips, at least 3-inches (76 mm) wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches (102 mm) on center.
  3. Longitudinal Seams: Overlap seams at least 1-1/2 inches (38 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (102 mm) on center. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F (2 deg C).
  4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
  5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
  6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches (51 mm) in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.
17. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply

insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches (51 mm) below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

18. Exterior Wall Penetrations: For penetrations of below grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor barrier coating.
19. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches (51 mm) from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."
20. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.
21. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.
22. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.
  1. Use same material and thickness as adjacent pipe insulation.
  2. Overlap nesting insulation by 2 inches (51 mm) or 1-pipe diameter, which ever is greater.

3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
  4. Insulate elbows and tees smaller than 3-inches (76 mm) pipe size with premolded insulation.
  5. Insulate elbows and tees 3 inches (76 mm) and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
  6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.
23. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 15 Section "Supports and Anchors." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches (305 mm) and taper and seal insulation ends.
1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.
24. Insulated cold pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory applied or field applied.
  2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
  3. Finish with glass cloth and vapor barrier adhesive.
  4. PVC fitting covers may be used.
  5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
  6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

25. For insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
3. Finish with glass cloth and adhesive.
4. PVC fitting covers may be used.
5. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
6. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

26. Inserts and Shields:

1. Application: Piping 2 inches (51 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (152 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

3.4 BELOW GROUND PIPE INSULATION INSTALLATION

1. General:

1. The following are additional requirements for insulation applied to piping installed below ground.

2. Coat bore surfaces of insulation materials with insulating cement of type recommended by insulation manufacturer. Apply enough cement to fill surface cells. Do not use adhesives for this coating.
3. Secure insulation with a minimum of 2 stainless-steel bands for each section of insulation.
4. Terminate insulation at anchor blocks.
5. Apply insulation continuously through sleeves and manholes, except as specified above for exterior wall penetrations.
6. Provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and (0.0025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

### 3.5 GLASS FIBER PIPE INSULATION INSTALLATION

1. Bond insulation to pipe with lagging adhesive.
2. Seal exposed ends with lagging adhesive.
3. Seal seams and joints with vapor barrier compound.

### 3.6 CELLULAR GLASS PIPE INSULATION INSTALLATION

1. Cellular Glass Insulation:
  1. Join sections of cellular glass insulation with vapor barrier compound. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.
  2. Multiple Layer Installations: Stagger joints of multilayer installations. Secure inner layer with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.
  3. Finishing: Apply manufacturer's recommended weather barrier mastic.

### 3.7 CELLULAR FOAM INSULATION INSTALLATION

1. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
2. Valves, Fittings, and Flanges:
  1. Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
  2. Miter cut materials to cover soldered elbows and tees.
  3. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

### 3.8 JACKETS

1. Foil and Paper Jackets (FP):
  1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch (38 mm)laps at longitudinal joints and 3-inch (76 mm)wide butt strips at end joints.
  2. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.
2. Install metal jacket with 2-inch (51 mm) overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches (305 mm) on center and at butt joints.
3. Install the PVC jacket with 1-inch (25 mm) overlap at longitudinal and butt joints and seal with adhesive.
4. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install



the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch (51mm) overlap at joints. Embed glass cloth between (2) 1/16-inch (1.6 mm) thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

5. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet (3 meters) above finished floor, finish with PVC jacket and fitting covers.
6. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
7. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### 3.9 FINISHES

1. Paint finished insulation as specified in Division 9 Section "Painting."
2. Flexible Elastomeric Cellular Foam Insulation:
  1. After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

### 3.10 TOLERANCE

1. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

### 3.11 GLASS FIBER INSULATION SCHEDULE

#### PIPING SYSTEMS

##### 1. Plumbing Systems

Domestic Hot Water Supply  
Domestic Hot Water Recirc  
Domestic Cold Water  
Roof Drain Bodies  
Roof Drainage Run Horizontal  
Plumbing Vents Within 10 Feet  
(3 Meters) of the Exterior

##### 2. Heating Systems

Heating Hot Water Supply  
Heating Hot Water Return

##### 3. Cooling Systems

Chilled Water Supply  
Chilled Water Return  
Cooling Coil Condensate Drains

##### 4. Other Systems

Piping Exposed to Freezing  
with Heat Tracing

### 3.12 CELLULAR GLASS INSULATION SCHEDULE

#### PIPING SYSTEMS

##### 1. Plumbing Systems

Domestic Hot Water Supply  
Domestic Hot Water Recirc  
Domestic Cold Water  
Roof Drain Bodies  
Roof Drainage Run Horizontal  
Plumbing Vents Within 10 Feet  
(3 Meters) of the Exterior

##### 2. Heating Systems

Heating Hot Water Supply  
Heating Hot Water Return

3. Cooling Systems

Chilled Water Supply  
Chilled Water Return  
Cooling Coil Condensate Drains

4. Other Systems

Piping Exposed to Freezing  
with Heat Tracing

3.13 CELLULAR FOAM INSULATION SCHEDULE

PIPING SYSTEMS

1. Plumbing Systems

Domestic Hot Water Supply  
Domestic Hot Water Recirc  
Domestic Cold Water  
Roof Drain Bodies  
Roof Drainage Run Horizontal  
Plumbing Vents Within 10 Feet  
(3 Meters) of the Exterior

2. Heating Systems

Heating Hot Water Supply  
Heating Hot Water Return

3. Cooling Systems

Chilled Water Supply  
Chilled Water Return  
Cooling Coil Condensate Drains

4. Other Systems

Piping Exposed to Freezing  
with Heat Tracing

### 3.14 Above Ground Cold Pipeline Insulation Thickness

		Pipe Size, Inches (mm)						
Service or Range of Temp degrees F (degrees C)	Run- outs*	1/4 to	1/4 to	1-1/2	3-1/2	6 to	12 to	26 to
		1-1/2 (6 to 38)	1-1/4 (6 to 32)	to 3 (38 to 76)	to 5 (89 to 125)	10 (152 to 254)	24 (305 to 610)	33 (660 to 838)
60 to 35 (CF)	2	1	1	1				
(16 to 2) (CG)			1-1/2	1-1/2	2	2	2	2
(GF)		1	1	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
34 to 0 (CG)			2-1/2	2-1/2	2-1/2	3	3	3-1/2
(1 to -17) (GF)			1-1/2	1-1/2	2	2	2-1/2	2-1/2
-1 to -30 (CG)			3	3	3	3-1/2	3-1/2	4
(-18 to -34) (GF)			1-1/2	2	2-1/2	2-1/2	3	3
Domestic (CF)			2	2	2			
Cold Water (CG)			1	1	1-1/2	1-1/2	1-1/2	
and Interior (MF)			2	2	2	1	1	1
Roof Drain Lines (Horizontal portions only)								

NOTES: (CG) - Cellular Glass  
(GF) - Glass Fiber  
(CF) - Cellular Foam

- When runouts to terminal units exceed 12 feet (3.7 m), the entire length of runout shall be insulated like the main feed pipe.
-

3.15 REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION FOR HANDLING FLUIDS OTHER THAN DOMESTIC HOT WATER TO 250 DEGREES F (121 degrees C).

k = thermal conductivity (average) Btu/hr. sq. ft.  
degree/in. thickness at a mean temperature of 75  
degrees F (29 degrees C).

Thermal conductivity k	Pipe Size, Inches (mm)						
	2 or >	2-1/2 to 3	4	5 to 6	8	10	12
	(51 or >)	(64 to 76)	(102)	(127 to 152)	(63)	(254)	(305)
0.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5
0.30	1.5	2.0	2.5	2.5	2.5	2.5	3.0
0.35	2.0	2.5	2.5	2.5	3.5	3.5	3.5
0.40	2.5	3.5	3.5	3.0	4.0	4.0	4.0
0.45	3.0	4.0	4.0	3.5	4.5	4.5	4.5

3.16 REQUIRED THICKNESS (IN INCHES) OF PIPE INSULATION FOR PIPES HANDLING DOMESTIC HOT WATER. (GF) - GLASS FIBER, (CG) - CELLULAR GLASS, (CF) - CELLULAR FOAM

Range of Service degrees F (degrees C)	Runouts* 1/4 to 1-1/2" (6 to 38)	Pipe Size, Inches (mm)						
		2 or less (51 or >)	2-1/2 to 3 (63 to 76)	4 (102)	5 to 6 (127 to 152)	8 (203)	10 (254)	12 (305)
61 to 200 (GF)		1.0	1.5	1.5	1.5	1.5	1.5	1.5
(16 to 93) (CG)		1.5	2.5	2.5	2.0	2.0	2.0	2.0
	(CF) 2	1.0	1.5	1.5	1.5			

\* When runouts to terminal units exceed 12 feet, (3.7 m) the entire length of runout shall be insulated like the main feed pipe.

END OF SECTION



SECTION 15280

EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Equipment insulation.
2. Covering.
3. Breeching insulation.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1. Placement of inserts and insulation shields.

1.3 RELATED SECTIONS

1. Section 09900 - Painting: Painting insulation covering.
2. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS  
(Latest Edition or Revision)

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
3. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
4. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
5. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
6. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
7. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

8. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
10. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
11. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
12. ASTM C640 - Corkboard and Cork Pipe Thermal Insulation.
13. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
14. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
15. ASTM E84 - Surface Burning Characteristics of Building Materials.
16. ASTM E96 - Water Vapor Transmission of Materials.
17. NFPA 255 - Surface Burning Characteristics of Building Materials.
18. UL 723 - Surface Burning Characteristics of Building Materials.
19. ASHRAE 90A - Energy Conservation in New Building Design.
20. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.
21. ASTM C 547 - Specification for Mineral Fiber Preformed Pipe Insulation.
22. ASTM D 579 - Specification for Greige Woven Glass Fabrics.
23. NFPA 90A - Air Conditioning & Ventilating Systems.
24. NFPA 90B - Warm Air Heating & Air Conditioning Systems.



25. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.
26. NFPA 220 - Standard on Types of Building Construction.

#### 1.5 SUBMITTALS

1. Government approval is required for submittal with a OGAO designation; submittal having an OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
2. Product Data: Provide product description, list of materials, k-value, and thickness for equipment scheduled.
3. Material Certificates: Submit material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.
4. Test Reports: Submit test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.
5. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

#### 1.6 QUALITY ASSURANCE

1. Fire Performance Characteristics: Conform to the following characteristics for insulation facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
2. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required

to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

#### 1.7 QUALIFICATIONS

1. Applicator: Company specializing in performing the work of this section with minimum three years experience.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
2. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.
3. Store insulation in original wrapping and protect from weather and construction traffic.
4. Protect insulation against dirt, water, chemical, and mechanical damage.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
2. Maintain temperature during and after installation for minimum period of 24 hours.

#### 1.10 SEQUENCING AND SCHEDULING

1. Schedule insulation application testing of equipment.

### PART 2 PRODUCTS

#### 2.1 GLASS FIBER, RIGID

1. Acceptable Manufacturers:
  1. Owens-Corning.

2. Certainteed Corp.
  3. Manville/Schuller.
  4. Knauf Fiber Glass.
  5. Approved equal under provisions of Divisions 0 and 1.
2. Insulation shall meet requirements of ASTM C612, and shall be rigid and noncombustible.
    1. 'K' ('ksi') value : ASTM C335, 0.24 at 75 degrees F (0.035 at 24 degrees C).
    2. Maximum service temperature: 1200 degrees F (650 degrees C).
    3. Maximum moisture absorption: 0.1 percent by volume.
    4. Density: 3.0]lb/cu ft (48 kg/cu m) density.
3. Vapor Barrier Jacket
    1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
    2. Moisture vapor transmission: ASTM E96; [0.04] perm. inches.
    3. Secure with self sealing longitudinal laps and butt strips.
    4. Secure with outward clinch expanding staples and vapor barrier mastic.
4. Facing: 1 inch (25 mm) stainless steel hexagonal wire mesh stitched on both faces of insulation.
5. Vapor Barrier Lap Adhesive
    1. Acceptable Manufacturers:
      1. Approved under provisions of Divisions 0 and 1.
    2. Adhesive shall be waterproof, fire-retardant type, and shall be compatible with insulation used.

6. Insulating Cement/Mastic

1. Acceptable Manufacturers:

1. Approved under provisions of Divisions 0 and 1.
2. Cement/mastic shall meet requirements of ASTM C195 with hydraulic setting on mineral wool, and shall be compatible with insulation used.

2.2 CELLULAR GLASS

1. Acceptable Manufacturers:

1. Pittsburgh Corning Corp.
  2. Approved equal under provisions of Divisions 0 and 1.
2. Insulation shall meet requirements of ASTM C552.
1. 'K' ('Ksi') value: 0.35 at 75 degrees F (0.047 at 24 degrees C).
  2. Density: 8.0 lb/cu ft (128 kg/cu m).

2.3 CELLULAR FOAM

1. Acceptable Manufacturers:

1. Armstrong World Industries, Inc.
  2. Halstead Industrial Products.
  3. Rubatex Corp.
  4. Approved equal under provisions of Divisions 0 and 1.
2. Insulation shall meet requirements of ASTM C534, and shall be flexible, cellular elastomeric, molded or sheet.
1. 'K' ('ksi') value: ASTM C177 or C518; 0.27 at 75 degrees F (0.27 at 24 degrees C).
  2. Minimum service temperature: -40 degrees F (-40 degrees C).

3. Maximum service temperature: 220 degrees F (104 degrees C).
  4. Maximum moisture absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
  5. Moisture vapor transmission: ASTM E96; 0.17 perm inches.
  6. Maximum flame spread: ASTM E84; 25.
  7. Maximum smoke developed: ASTM E84; 50.
  8. Connection: Waterproof vapor barrier adhesive.
3. Elastomeric Foam Adhesive
1. Acceptable Manufacturers:
    1. Approved under provisions of Division 0 and 1.
  2. Adhesive shall be air dried, contact type, and shall be compatible with insulation used.

## 2.4 JACKETS

1. PVC Plastic
  1. Acceptable Manufacturers:
    1. Approved under provisions of Division 0 and 1.
  2. Jacket shall meet requirements of ASTM C921, and shall be Sheet material, with off white color.
    1. Minimum service temperature: -40 degrees F (-40 degrees C).
    2. Maximum service temperature: 150 degrees F (66 degrees C).
    3. Moisture vapor transmission: ASTM E96; 0.002 perm inches.
    4. Maximum flame spread: ASTM E84; 25.

5. Maximum smoke developed: ASTM E84; 50.
6. Thickness: 30 mil (0.76 mm).
7. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic
  1. Acceptable Manufacturers:
    - (1) Approved under provisions of Division 0 and 1.
  2. Mastic shall be compatible with insulation used.
2. Canvas Jacket shall be UL listed.
  1. Fabric: ASTM C921, 6 oz/sq yd (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.
  2. Lagging Adhesive
    1. Acceptable Manufacturers:
      - (1) Approved under provisions of Division 0 and 1.
    2. Adhesive shall be water proof, fire-retardant type, and shall be compatible with insulation used.
3. Aluminum Jacket shall meet requirements of ASTM B209.
  1. Thickness: 0.025 inch (0.064 mm) sheet.
  2. Finish: Smooth.
  3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
  4. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.
4. Stainless Steel Jacket shall be: Type 304 stainless steel.
  1. Thickness: 0.016inch (0.41 mm).

2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

1. Verify that equipment has been tested before applying insulation materials.
2. Verify that surfaces are clean, foreign material removed, and dry.

#### 3.2 PREPARATION

1. Surface Preparation:
  1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.
2. Mixing:
  1. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.
  2. Follow cement manufacturer's printed instructions for mixing and portions.

#### 3.3 INSTALLATION

1. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical systems. Install materials in accordance with manufacturer's instructions.
2. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation of jacket in either the wet or dry state.
3. Install vapor barriers on insulated equipment having surface operating temperatures below 60 deg F (16 deg C).
4. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

5. Install insulation with smooth, straight, and even surfaces.
6. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier. On exposed equipment, locate insulation, and cover seams in least visible locations.
7. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.
8. Seal Ends: Except for flexible elastomeric cellular foam insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular foam insulation square and seal with adhesive.
9. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.
10. Keep insulation materials dry during application and finishing.
11. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.
  1. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
  2. Flexible connectors.
  3. Vibration control devices.
  4. Testing laboratory labels and stamps.
  5. Nameplates and data plates.
  6. Access panels and doors in air distribution systems.
12. Install board and block materials with a minimum dimension of 12 inches (305 mm) and a maximum dimension of 48 inches (1219 mm).
13. Groove, score, and bevel insulation materials as required to fit as closely as possible to the equipment, and to fit contours of equipment. Stagger end joints. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.



14. Insulation Thicknesses Greater than 2 Inches (51 mm):  
Install insulation in multiple layers with staggered joints.
15. Bevel insulation edges for cylindrical surfaces for tight joint.
16. Secure sections of insulation in place with wire or bands spaced at 9 inches (229 mm) centers, except for flexible elastomeric cellular foam insulation.
17. Protect exposed corners with corner angles under wires and bands.
18. Manholes, Handholes and Information Plates: Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
19. Removable Insulation: Install insulation on components that require periodic inspecting, cleaning, and repairing for easy removal and replacement without damage to adjacent insulation.
20. Pumps: Where insulation is indicated, fabricate galvanized steel boxes lined with insulation. Fit boxes around pumps and coincide joints in box with the splits in the pump casings. Fabricate joints with outward bolted flanges.
21. Finishing: Except for flexible elastomeric cellular foam insulation, apply 2 coats of vapor barrier compound to a minimum thickness of 1/16 inch (1.6 mm). Install a layer of glass cloth embedded between layers.
22. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
23. Insulated equipment containing fluids below ambient temperature:
  1. Provide vapor barrier jackets, factory applied or field applied.
  2. Finish with glass cloth and vapor barrier adhesive.
  3. Insulate entire system.

24. For insulated equipment containing fluids above ambient temperature:
  1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
  2. Finish with glass cloth and adhesive.
  3. For hot equipment containing fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
  4. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.
25. Inserts and Shields:
  1. Application: equipment 1-1/2 inches (38 mm) diameter or larger.
  2. Shields: galvanized steel between hangers and inserts.
  3. Insert location: between support shield and equipment and under the finish jacket.
  4. Insert configuration: minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  5. Insert material: hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
26. Install insulation for equipment requiring access for maintenance, repair, or cleaning, in such a manner that it can be easily removed and replaced without damage. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

#### 3.4 GLASS FIBER EQUIPMENT INSULATION INSTALLATION

1. Secure insulation with anchor pins and speed washers.

2. Space anchors at maximum intervals of 18 inches (457 mm) in both directions and not more than 3 inches (76 mm) from edges and joints.
3. Apply a smoothing coat of insulating and finishing cement to finished insulation.

### 3.5 CELLULAR GLASS EQUIPMENT INSULATION INSTALLATION

1. Join sections of insulation with vapor barrier compound.
2. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.
3. Secure inner layer of multiple layer installations with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.

### 3.6 CELLULAR FOAM INSULATION INSTALLATION

1. Install sheets of the largest manageable size.
2. Apply full coverage of adhesive to the surfaces of the equipment and to the insulation.
3. Butt insulation joints firmly together and apply adhesive to insulation edges at joints.

### 3.7 JACKETS

1. Foil and Paper Jackets (FP)
  1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch (38 mm) laps at longitudinal joints and 3-inch (76 mm) wide butt strips at end joints.
  2. Seal openings, punctures, and breaks in vapor barrier jackets, and exposed insulation with vapor barrier compound.
2. Interior Exposed Insulation: Install continuous glass cloth jackets.

3. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch (51 mm) overlap at joints. Embed glass cloth between (2) 1/16-inch (1.6 mm) thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.
4. For equipment in mechanical equipment rooms or in finished spaces, finish with PVC jacket and fitting covers.
5. For exterior applications, provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

### 3.8 FINISHES

1. Paint finished insulation as specified in Division 9 Section "Painting."
2. Flexible Elastomeric Cellular Foam Insulation:
  1. After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.
3. Cover glass fiber, cellular glass or cellular foam insulation with metal mesh and finish with heavy coat of insulating cement.

### 3.9 TOLERANCE

1. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

### 3.10 GLASS FIBER, RIGID INSULATION SCHEDULE

<u>EQUIPMENT</u>		<u>THICKNESS</u> <u>Inch (mm)</u>	
1.	<u>Plumbing Systems</u>		
	Domestic Hot Water Storage Tanks	2"	(51mm)
2.	<u>Heating Systems</u>		
	Pump Bodies	2"	(51mm)
	Air Separators	2"	(51mm)
	Expansion Tanks	2"	(51mm)
	Flue Gas Breeching	6"	(152mm)
	Induced Draft Fan Scrolls	2"	(51mm)
	Stacks to Roof	6"	(152mm)
	Boiler and Flue Boxes	6"	(152mm)
	Boiler Drum Heads	6"	(152mm)
3.	<u>Cooling Systems</u>		
	Pump Bodies	1-1/2"	(38mm)
	Air Separators	1-1/2"	(38mm)
	Expansion Tanks	1-1/2"	(38mm)
	Chiller cold surfaces (Not Factory Insulated)	2-1/2"	(64mm)
4.	<u>Other Systems</u>		
	Equipment Exposed to Freezing with Heat Tracing	2-1/2" to 3"	(64mm to 76mm)
5.	<u>Basis For Insulation Thickness:</u>		
6.	Equipment Handling Media Between 35 deg F & 60 deg F: (2 deg C and 15 deg C)	1-1/2" mineral fiber	(38mm)
	Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" mineral fiber	(51mm)
	Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" mineral fiber	(89mm)
	Equipment Handling Media Between 401 deg F & 600 deg F: (205 deg C and 316 deg C)	6" mineral fiber	(152mm)

<u>EQUIPMENT</u>	<u>THICKNESS</u> <u>Inch (mm)</u>
Equipment Handling Media Above 600 deg F: (316 deg C)	(49 deg C) Thickness required to limit exterior surface temp. to 120 deg F

### 3.11 CELLULAR GLASS INSULATION SCHEDULE

<u>EQUIPMENT</u>	<u>THICKNESS</u> <u>Inch (mm)</u>
1. <u>Plumbing Systems</u>	
Domestic Hot Water Storage Tanks	2" (51mm)
2. <u>Heating Systems</u>	
Pump Bodies	2" (51mm)
Air Separators	2" (51mm)
Expansion Tanks	2" (51mm)
Flue Gas Breeching	6" (152mm)
Induced Draft Fan Scrolls	2" (51mm)
Stacks to Roof	6" (152mm)
Boiler and Flue Boxes	6" (152mm)
Boiler Drum Heads	6" (152mm)
3. <u>Cooling Systems</u>	
Pump Bodies	2" (51mm)
Air Separators	2" (51mm)
Expansion Tanks	2" (51mm)
Chiller cold surfaces(Not Factory Insulated)	3-1/2" (89mm)
4. <u>Other Systems</u>	
Equipment Exposed to Freezing with Heat Tracing	3-1/2" to 4" (89mm to 102mm)
5. <u>Basis For Insulation</u> <u>Thickness:</u>	
Equipment Handling Media Between 35 deg F & 60 deg F: (2 deg C and 15 deg C)	2" Cellular Glass (51mm)

<u>EQUIPMENT</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	
Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" Cellular Glass	(51mm)
Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" Cellular Glass	(89mm)
Equipment Handling Media Between 401 deg F & 600 deg F: (205 deg C and 316 deg C)	6" Cellular Glass	(152mm)
Equipment Handling Media Above 600 deg F: (316 deg C)	Thickness required to limit exterior surface temp. to 120 deg F	(49 deg C)

### 3.12 CELLULAR FOAM INSULATION SCHEDULE

<u>EQUIPMENT</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	
1. <u>Plumbing Systems</u> Domestic Hot Water Storage Tanks	2"	(51mm)
2. <u>Heating Systems</u> Pump Bodies	2"	(51mm)
Air Separators	2"	(51mm)
Expansion Tanks	2"	(51mm)
Flue Gas Breeching	6"	(152mm)
Induced Draft Fan Scrolls	2"	(51mm)
Stacks to Roof	6"	(152mm)
Boiler and Flue Boxes	6"	(152mm)
Boiler Drum Heads	6"	(152mm)
3. <u>Cooling Systems</u> Pump Bodies	1-1/2"	(38mm)
Air Separators	1-1/2"	(38mm)
Expansion Tanks	1-1/2"	(38mm)
Chiller cold surfaces (Not Factory Insulated)	2-1/2"	(64mm)

<u>EQUIPMENT</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	
4. <u>Other Systems</u>		
Equipment Exposed to Freezing with Heat Tracing	2-1/2" to 3"	(64mm to 76mm)
5. <u>Basis For Insulation</u> <u>Thickness:</u>		
Equipment Handling Media Between 35 deg F & 60 deg F: (2deg C and 15 deg C)	1-1/2" Cellular Foam	(38mm)
Equipment Handling Media Between 61 deg F & 250 deg F: (16 deg C and 121 deg C)	2" Cellular Foam	(51mm)
Equipment Handling Media Between 251 deg F & 400 deg F: (122 deg C and 204 deg C)	3-1/2" Cellular Foam	(89mm)
Equipment Handling Media Between 401 deg F & 600 deg F: (205 deg C and 316 deg C)	6" Cellular Foam	(152mm)
Equipment Handling Media Above 600 deg F: (316 deg C)	Thickness required to limit exterior surface temp. to 120 deg F	(49 deg C)

END OF SECTION



SECTION 15290

DUCTWORK INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Ductwork insulation.
- B. Insulation jackets.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Installation and finishing of outdoor insulation jacket under roofing.

1.3 RELATED SECTIONS

- A. Division 7 - THERMAL AND MOISTURE PROTECTION: Finishing outdoor insulation jacket.
- B. Section 09900 - Painting: Painting insulation jackets.
- C. Section 15190 - Mechanical Identification.

1.4 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- E. ASTM E84 - Surface Burning Characteristics of Building Materials.
- F. ASTM E96 - Water Vapor Transmission of Materials.
- G. NFPA 255 - Surface Burning Characteristics of Building Materials.
- H. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

- I. UL 723 - Surface Burning Characteristics of Building Materials.
  - J. ASHRAE 90A - Energy Conservation in New Building Design.
  - K. ASTM A 167 - Specification for Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.
  - L. ASTM C 195 - Specification for Mineral Fiber Thermal Insulating Cement.
  - M. ASTM C 449 - Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating & Finishing Cement.
  - N. ASTM C 534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet & Tubular Form.
  - O. ASTM C 921 - Specification for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - P. NFPA 90A - Air Conditioning & Ventilating Systems.
  - Q. NFPA 90B - Warm Air Heating & Air Conditioning Systems.
  - R. NFPA 96 - Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment.
  - S. NFPA 220 - Standard on Types of Building Construction.
- 1.5 SUBMITTAL: Government approval is required for submittal with a OGAO designation; submittal having an OFIOO desingation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Product Data: Provide product description, list of materials, k-value, and thickness for each service, and locations.
  - B. Material Certificates: Submit material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.
  - C. Test Reports: Submit material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

- D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

#### 1.6 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority, having jurisdiction. Label insulation with appropriate markings of testing laboratory.
- B. Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

#### 1.7 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

## 1.10 SEQUENCING AND SCHEDULING

- A. Schedule insulation application after testing of duct systems.

## PART 2 PRODUCTS

### 2.1 GLASS FIBER, FLEXIBLE

#### A. Acceptable Manufacturers:

- 1. Owens-Corning.
- 2. Certainteed Corp.
- 3. Manville/Schuller.
- 4. Knauf Fiber Glass.
- 5. Approved equal under provisions of Divisions 0 and 1.

#### B. Insulation shall meet requirements of ASTM [C553] [C612], and shall be flexible, noncombustible blanket type.

- 1. 'K' ('Ksi') value : ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).
- 2. Maximum service temperature: 250 degrees F (121 degrees C).
- 3. Maximum moisture absorption: 0.20 percent by volume.
- 4. Density: 0.75 lb/cu ft (12 kg/cu m).

#### C. Vapor Barrier Jacket

- 1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
- 2. Moisture vapor transmission: ASTM E96; 0.04 perm inches.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Acceptable Manufacturers:

a) Approved under provisions of Divisions 0 and 1.

2. Tape shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire shall be Annealed steel, 16 gage (1.6 mm).

2.2 GLASS FIBER, RIGID

A. Acceptable Manufacturers:

1. Owens-Corning.

2. Certainteed Corp.

3. Manville/Schuller.

4. Knauf Fiber Glass.

5. Approved equal under provisions of Divisions 0 and 1.

B. Insulation shall meet requirements of ASTM C612, and shall be rigid, noncombustible blanket.

1. 'K' ('Ksi') value : ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).

2. Maximum service temperature: 250 degrees F (121 degrees C).

3. Maximum moisture absorption: 0.20 percent by volume.

4. Density: 2.0 lb/cu ft (32 kg/cu m).

C. Vapor Barrier Jacket

1. Jacket shall be Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

2. Moisture vapor transmission: ASTM E96; 0.04 perm inches.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Acceptable Manufacturers:
  - a) Approved under provisions of Divisions 0 and 1.
2. Tape shall be Kraft paper reinforced with glass fiber yarn, and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.3 JACKETS

A. Canvas Jacket shall be UL listed

1. Fabric: 6 oz/sq yd (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.
2. Lagging Adhesive
  - a) Acceptable Manufacturers:
    - 1) Approved under provisions of Divisions 0 and 1.
    - b) Adhesive shall be compatible with insulation used.

B. Outdoor Jacket shall be asphalt impregnated and coated mineral fiber sheet, 50 lb/sq yd (27.1 kg/sq m).

C. Aluminum Jacket shall meet requirements of ASTM B209.

1. Thickness: 0.016 inch (0.041 mm) sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch (51 mm) laps.
4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.2 PREPARATION

- A. Surface Preparation:
  - 1. Clean, dry, and remove foreign materials such as rust, scale, and dirt.
- B. Mixing:
  - 1. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.
  - 2. Follow cement manufacturer's printed instructions for mixing and portions.

### 3.3 INSTALLATION

- A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system. Install materials in accordance with manufacturer's instructions.
- B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.
- C. Install vapor barriers on insulated ducts and plenums having surface operating temperatures below 60 deg F (16 deg C).
- D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.
- E. Install insulation with smooth, straight, and even surfaces.
- F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

- G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.
- H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree (0.79 Rad) angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.
- I. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.
- J. Keep insulation materials dry during application and finishing.
- K. Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment.
  - 1. Factory-insulated flexible ducts.
  - 2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
  - 3. Flexible connectors.
  - 4. Vibration control devices.
  - 5. Testing laboratory labels and stamps.
  - 6. Nameplates and data plates
  - 7. Access panels and doors in air distribution systems.
- L. Install block and board insulation as follows:
  - 1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches (305 mm) apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
  - 2. Speed Washers Attachment: secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches (457 mm) apart each way and 3 inches (76 mm) from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.



M. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches (610 mm): Bonding adhesive applied in 6-inch-wide transverse strips on 12-inch (305 mm) centers.
2. 24 Inches (610 mm) and Larger: Anchor pins spaced 12 inches (305 mm) apart each way. Apply bonding adhesive to prevent sagging of the insulation.
3. Overlap joints 3 inches (76 mm).
4. Seal joints, breaks and punctures with vapor barrier compound.

N. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

O. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

### 3.4 JACKETS

A. Foil and Paper Jackets (FP):

1. Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure

with adhesive. Install jackets with 1-1/2 inch (38 mm) laps at longitudinal joints and 3-inch (76 mm) wide butt strips at end joints.

2. Seal openings, punctures, and breaks in vapor barrier jackets, and exposed insulation with vapor barrier compound.

B. For ductwork exposed in mechanical equipment rooms or in finished spaces below 10 feet (3 meters) above finished floor, finish with aluminum jacket.

C. For exterior applications, provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

### 3.5 FINISHES

A. Paint finished insulation as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

### 3.6 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

### 3.7 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

<u>DUCTWORK</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	<u>FINISH</u>
Combustion Air Duct	1-1/2" (38mm)	Aluminum Jacket
Exhaust Ducts Within 10 ft (3 m) of Exterior Openings	1-1/2" (38mm)	Aluminum Jacket
Exhaust Ducts Exposed to Outdoor Air	1-1/2" (38mm)	Aluminum Jacket
Outside Air Intake Ducts	1-1/2" (38mm)	Aluminum Jacket
Return Air Ducts & Plenums	2" (51mm)	Aluminum Jacket
Supply Air Plenums	2" (51mm)	Aluminum Jacket
Ventilation Equipment Casings	2" (51mm)	Aluminum Jacket
Supply Ducts	2" (51mm)	Aluminum Jacket
Supply Ducts From Fans	2" (51mm)	Aluminum Jacket
to Vertical Ducts in Shafts	2" (51mm)	Aluminum Jacket
Supply Ducts in Vertical Shafts	2" (51mm)	Aluminum Jacket
Supply ducts After Terminal Boxes	2" (51mm)	Aluminum Jacket

<u>DUCTWORK</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	<u>FINISH</u>
Return and Relief Ducts in Mechanical Rooms	1-1/2" (38mm)	Aluminum Jacket
Ducts Exposed to Outdoors	2" (51mm)	Aluminum Jacket

3.8 RIGID GLASS FIBER DUCTWORK INSULATION SCHEDULE

<u>DUCTWORK</u>	<u>THICKNESS</u> <u>Inch (mm)</u>	<u>FINISH</u>
Combustion Air Duct	1-1/2" (38mm)	Aluminum Jacket
Exhaust Ducts Within 10 ft (3 m) of Exterior Openings	1-1/2" (38mm)	Aluminum Jacket
Exhaust Ducts Exposed to Outdoor Air	1-1/2" (38mm)	Aluminum Jacket
Outside Air Intake Ducts	1-1/2" (38mm)	Aluminum Jacket
Return Air Ducts and Plenums	2" (51mm)	Aluminum Jacket
Supply Air Plenums	2" (51mm)	Aluminum Jacket
Ventilation Equipment Casings	2" (51mm)	Aluminum Jacket
Supply Ducts	2" (51mm)	Aluminum Jacket
Supply Ducts From Fans to Vertical Ducts in Shafts	2" (51mm)	Aluminum Jacket
Supply Ducts in Vertical Shafts	2" (51mm)	Aluminum Jacket
Supply ducts After Terminal Boxes	2" (51mm)	Aluminum Jacket
Return and Relief Ducts in Mechanical Rooms	1-1/2" (38mm)	Aluminum Jacket
Ducts Exposed to Outdoors	2" (51mm)	Aluminum Jacket

END OF SECTION



SECTION 15330

FIRE PROTECTION PIPING

PART 1 GENERAL

1.1 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Casting
ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1990) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 795	(1996) Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM G 88	(1996) Seamless Copper Water Tube
ASTM D 3309	(1996a) Polybutylene (PB) Plastic Hot and Cold Water Distribution Systems
ASTM F 442	(1994) Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged
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ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.4	(1992) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)
AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)	
ASSE 1015	(1993) Double Check Backflow Prevention Assembly
AMERICAN WATER WORKS ASSOCIATION (AWWA)	
AWWA-01	(1995) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1992) Hypochlorite
AWWA B301	(1992) Liquid Chlorine
AWWA ANSI/AWWA 4/A21.4	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA ANSI/AWWA C110/A21.10	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (75 mm through 1200mm), for Water and Other Liquids
AWWA ANSI/AWWA C111/A21.11	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and

Fittings

AWWA ANSI/AWWA C151/A21.51 (1996) Ductile-Iron  
Pipe,Centrifugally Cast, for Water  
or Other Liquids

AWWA C203 (1991) Coal-Tar Protective Coating  
and Linings for Steel Water  
Pipelines - Enamel and Tape - Hot  
Applied

AWWA M20 (1973) Manual: Water Chlorination  
Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (1998) Approval Guide Fire  
Protection

FM P7825b (1998) Approval Guide Electrical  
Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-71 (1997)Cast Iron Swing Check Valves,  
Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1996; Errata 13-96-1) Installation  
of Sprinkler Systems

NFPA 13R (1996) Installation of Sprinkler  
Systems in Residential Occupancies  
Up to and Including Four Stories in  
Height

NFPA 24 (1995) Installation of Private Fire  
Service Mains and Their  
Appurtenances

NFPA 231C (1995; TIA 95-1) Rack Storage of  
Materials

NFPA 1963 (1993) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES  
(NICET)

NICET 1014 (1995) Program Detail Manual for  
Certification in the Field of Fire  
Protection Engineering Technology  
(Field Code 003) Subfield of  
Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 668 (1995) Hose Valves for Fire  
Protection Service

UL Bid Mat Dir (1998) Building Materials Directory

UL Fire Prot Dir (1998) Fire Protection Equipment  
Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinkler shall be in accordance with NFPA 231C. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

A. HYDRAULIC DESIGN

Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13.

B. HOSE DEMAND

An allowance for total combined inside and outside hose streams shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

C. BASIS FOR CALCULATIONS

Hydraulic calculations shall be based upon the Hazen-Williams formula with a (C) value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

D. SPRINKLER SPACING



Sprinklers shall be uniformly spaces on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for light ordinary hazard occupancy.

- 1.3 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. Submittal related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog dat, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

A. Load Calculations for Sizing Sway Bracing:

1. For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

B. Sprinkler System Equipment:

1. Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

C. Hydraulic Calculations:

1. Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

D. Spare Parts:

1. Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

E. Sprinkler System Shop Drawings:

1. Detail drawings conforming to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:
  - a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
  - b. Floor plans drawn to a scale not less than 1:100  $1/80 = 1'00$  which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector=test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
  - c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
  - d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
  - e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

F. As-Built Drawings:

1. As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

G. Test Procedures:

1. Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.
- H. Preliminary Tests:
1. A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.
- I. Final Test:
1. Upon successful completion of tests specified under paragraph PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.
- J. Installer Qualifications:
1. Qualifications of the sprinkler installer.
- K. Submittal Preparer's Qualifications:
1. The name and documentation of certification of the individual who will prepare the submittal, prior to the submittal of the drawings and hydraulic calculations.
- L. Contractor's Material & Test Certificates
1. Certificates, as specified in NFPA 13, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.
- M. Sprinkler System
1. Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precaution. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

#### 1.4 HYDRAULIC CALCULATIONS

- A. Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fitting, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that they hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

#### 1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

- A. The sprinkler system submittal, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

#### 1.6 INSTALLER QUALIFICATIONS

- A. The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the

proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactory, in the manner intended, for a period of not less than 6 months.

#### 1.7 REGULATORY REQUIREMENTS

- A. Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word (shall) had been substituted for the word (should) wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to (authority having jurisdiction) shall be interpreted to mean the Contracting Officer.

#### 1.8 DELIVERY AND STORAGE

- A. Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

### PART 2 PRODUCTS

#### 2.1 GENERAL EQUIPMENT REQUIREMENTS

##### A. STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

##### B. REQUIREMENTS FOR FIRE PROTECTION SERVICE

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms (listed) or (approved) appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

##### C. NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

## 2.2 UNDERGROUND PIPING SYSTEMS

### A. PIPE

Piping from a point 150 mm 6 inches above the floor to the point of connection to the existing water mains shall be ductile iron with a rated working pressure of 1380 kPa (200psi) 200 psi conforming to AWWA ANSI/AWWA C151/A21.51, with cement mortar lining conforming to AWWA ANSI/AWWA C104/A21.4. Piping more than 1500 mm 5 feet outside the building walls shall comply with Section 02660 WATER DISTRIBUTION SYSTEM.

### B. FITTINGS AND GASKETS

Fittings shall be ductile iron conforming to AWWA ANSI/AWWA C110/A21.10. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA ANSI/ AWWA C111/A21.11.

### C. GATE VALVE AND INDICATOR POSTS

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm 3 feet above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

## 2.3 ABOVEGROUND PIPING SYSTEMS

Above piping shall be steel or copper.

### A. STEEL PIPING SYSTEM

#### 1. STEEL PIPE

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters Laboratories to have a corrosion resistance ratio (CRR)

of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2. FITTINGS FOR NON-GROOVED STEEL PIPE

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall be approved for fire protection systems. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

3. GROOVED MECHANICAL JOINTS AND FITTINGS

Joints and fittings shall be designed for not less than 1200 kPa (175 psi) 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

4. FLANGES

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm (1/16 inch) 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

B. COPPER TUBE SYSTEMS

1. COPPER TUBE

Copper tube shall conform to ASTM B 88, Types L and M.

2. COPPER FITTINGS

Cast copper alloy pressure fittings shall conform to ASME B16.18 and wrought copper and bronze pressure fittings shall conform to ASME B16.22.

C. PIPE HANGERS

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and size involved.

D. VALVES

1. CONTROL VALVE AND GATE VALVE

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2. CHECK VALVE

Check valve 50 mm (2 inches) 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and PM P7825b. Check valves 100 mm (4 inches) 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

3. HOSE VALVE

Valve shall comply with UL 668 and shall have a minimum rating of 2070 kPa (300 psi). 300 psi. Valve shall be non-rising stem, all bronze, 90 degree angle type, with 65 mm (2-1/2 inch) 2-1/2 inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Hose valve shall be provided with 65 to 40 mm (2-1/2 to 1-1/2 inch) 2-1/2 to 1-1/2 inch reducer. Hose valves shall be equipped with lugged cap with drip drain, cap gasket and chain. Valve finish shall be polished brass.

2.4 ALARM CHECK VALVE ASSEMBLY

Assembly shall include an alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, main drain, and other components as required for a fully operational system.

2.5 WATER MOTOR ALARM ASSEMBLY

Assembly shall include a body housing, impeller or pelton wheel, drive shaft, striker assembly, gong, wall plate and related components necessary for complete operation. Minimum 20 mm (3/4 inch) galvanized piping shall be provided



between the housing and the alarm check valve. Drain piping from the body housing shall be minimum 25 mm (1 inch) galvanized and shall be arranged to drain to the outside of the building. Piping shall be galvanized both on the inside and outside surfaces.

## 2.6 ALARM INITIATING AND SUPERVISORY DEVICES

### A. SPRINKLER WATERFLOW INDICATOR SWITCH, VANE TYPE

1. Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min (10 gpm) or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

### 2. SPRINKLER PRESSURE (WATERFLOW) ALARM SWITCH

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 15 mm (2 inch) NPT male pipe thread. The switch shall have a maximum service pressure rating of 1207 kPa (175 psi). There shall be two SPDT (Form C) contacts factory adjusted to operate at 28 to 55 kPa. 4 to 8 psi. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

### 3. VALVE SUPERVISORY (TAMPER) SWITCH

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

## 2.7 FIRE DEPARTMENT CONNECTIONS

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered (Auto Spkr) with a polished brass finish. The connection shall

have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm (2-1/2 inch) diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

## 2.8 SPRINKLERS

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Sprinklers with internal O-rings shall not be used.

### A. UPRIGHT SPRINKLER

Upright sprinkler shall be brass quick-response type and shall have a nominal 12.7 (2 inch) or 13.5 mm (17/32 inch) orifice.

### B. PENDENT SPRINKLER

Pendent sprinkler shall be the fusible strut or glass bulb type, recessed quick response type with nominal 12.7 mm (2 inch) or 13.5 mm (17/32 inch) orifice and matching escutcheon plate. Pendent sprinklers shall have a polished chrome finish and enamel, white finish for escutcheon plate finish.

### C. SIDE WALL SPRINKLER

Sidewall sprinkler shall have a nominal 12.7 mm (2 inch) 2 inch orifice. Sidewall sprinkler shall have a brass finish in unfinished areas, polished chrome finish in finished areas and a white enamel escutcheon plate finish. Sidewall sprinkler shall be the quick-response type.

## 2.9 DISINFECTING MATERIALS

### A. LIQUID CHLORINE

Liquid chlorine shall conform to AWWA B301.

### B. HYPOCHLORITE

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

## 2.10 ACCESSORIES

### A. SPRINKLER CABINET

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

B. PENDENT SPRINKLER ESCUTCHEON

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

C. PIPE ESCUTCHEON

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

D. SPRINKLER GUARD

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in unfinished areas.

E. IDENTIFICATION SIGN

Valve identification sign shall be minimum 150 mm wide x 50 mm high 6 inches wide x 2 inches high with enamel baked finish on minimum 1.214 mm (18 gauge) 18 gauge steel or 0.6 mm (0.24 inch) 0.024 inch aluminum with red letters on a white back ground or white letters on red background. Wording of sign shall include, but not be limited to (main drain,) (auxiliary drain,) (inspector's test,) (alarm test,) (alarm line,) and similar wording as required to identify operational components.

2.11 FIRE HOSE REEL ASSEMBLY

Assembly shall include nozzle, fire hose, reel, 40 mm (1-1/2 inch) valve, and bracket suitable for wall mounting. The assembly shall be semi-automatic type complete with Underwriters clip which permits controlled one-man operation whereby control valve can be opened, hose unreeled and clip released by pulling on hose. Valve shall be non-rising stem, all bronze, angle type with 40 mm (1-1/2 inch) American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Reel shall be of steel construction with red enamel finish and shall be equipped

with 30 meters 100 feet of 40 mm (1-1/2 inch) rubber lined fire hose. Nozzle shall be of the industrial combination fog-straight stream type with shutoff. Components of the assembly shall be listed in UL Fire Prot Dir.

## 2.12 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 1380 kPa (200 psi). The maximum pressure loss shall be 40 kPa 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly.

## PART 3 EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 231C.

### 3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

#### A. PROTECTION OF PIPING AGAINST EARTHQUAKE DAMAGE

The system piping shall be protected against damage from earthquakes. Seismic protection of the piping system shall be provided in accordance with NFPA 13 and Appendix A, with the exception that the (Earthquake Zones) map of Appendix A shall not apply to this project. Seismic protection shall include flexible couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required in MFAP 13 for protection of piping against damage from earthquakes. Branch lines shall be equipped with sway braces at the end sprinkler head and at intervals not exceeding 9m 30ft.

#### B. PIPING IN EXPOSED AREAS

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

C. PIPING IN FINISHED AREAS

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

D. PENDENT SPRINKLERS

Recessed pendent sprinklers to be installed in finished areas. Drop nipples to pendent sprinklers shall consist of minimum 25 mm (1 inch) pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. 12 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

1. PENDENT SPRINKLER LOCATIONS

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm 6 inches from ceiling grid.

E. UPRIGHT SPRINKLERS

Upright sprinklers with guards to be installed in unfinished areas. Riser nipples or (sprigs) to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm 30 inches in length shall be individually supported.

F. SIDEWALL SPRINKLERS

Standard sidewall sprinklers with guard to be installed in unfinished areas or semi-recessed with matching escutcheon plate in finished areas.

G. PIPE JOINTS

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings

shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

H. REDUCERS

Reductions in pipe sizes shall be made with on-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushing shall be installed with the outer face flush with the face of the fittings opening being reduced. Bushing shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm (2 inch.

I. PIPE PENETRATIONS

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 07270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanical adjustable segmented elastomer seal.

J. ESCUTCHEONS

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

K. INSPECTOR=S TEST CONNECTION

Unless otherwise indicated, test connection shall consist of 25 mm (1 inch) pipe connected to the remote branch line; a test valve located approximately 2 meters 7 feet above the

floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words (Inspector's Test.) The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

L. DRAINS

Main drain piping shall be provided to discharge [at a safe point outside the building][at the location indicated]. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

M. INSTALLATION OF FIRE DEPARTMENT CONNECTION

Connection shall be mounted [on the exterior wall approximately 900 mm 3 feet above finished grade][as shown]. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

N. IDENTIFICATION SIGNS

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 900 mm. 3 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203.

Piping more than 1500 mm 5 feet outside the building walls shall meet the requirements of Section 02660 WATER DISTRIBUTION SYSTEM.

### 3.4 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

### 3.5 ELECTRICAL WORK

- A. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 16721 FIRE ALARM SYSTEMS. Wiring color code shall remain uniform throughout the system.

### 3.6 DISINFECTION

- A. After all system components are installed and hydrostatic test are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorite or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA m20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique.



The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### 3.7 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900, PAINTING GENERAL.

### 3.8 PRELIMINARY TESTS

The system, including the underground water mains, and the above ground piping and system components, shall be tested to assure the equipment and components function as intended.

The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTAL.

#### A. UNDERGROUND PIPING

##### 1. FLUSHING

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

##### 2. HYDROSTATIC TESTING

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters (2 quarts) 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

#### B. ABOVEGROUND TESTING

##### 1. HYDROSTATIC TESTING

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa 200 psi or 350 kPa 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in

gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

C. TESTING OF ALARM DEVICES

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water- operated alarm devices shall be tested to verify proper operation.

D. MAIN DRAIN FLOW TEST

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTAL. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.9 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been complete, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of test previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

END OF SECTION

SECTION 15410

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Sanitary sewer piping system.
- D. Domestic water piping system.
- E. Storm water piping system.
- F. Natural gas piping system.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavating
- B. Section 02223 - Backfilling
- C. Section 02225 - Trenching
- D. Section 02675 - Disinfection of Water Distribution System
- E. Section 08305 - Access Doors
- F. Section 09900 - Painting
- G. Section 15121 - Expansion Compensation
- H. Section 15140 - Supports and Anchors
- I. Section 15190 - Mechanical Identification
- J. Section 15245 - Vibration Isolation
- K. Section 15260 - Piping Insulation
- L. Section 15430 - Plumbing Specialties
- M. Section 15440 - Plumbing Fixtures

N. Section 15450 - Plumbing Equipment

1.3 REFERENCES

- A. ANSI B31.1 - Power Piping
- B. ANSI B31.2 - Fuel Gas Piping
- C. ANSI B31.9 - Building Service Piping
- D. ASME - Boiler and Pressure Vessel Code
- E. ASME Sec. 9 - Welding and Brazing Qualifications
- F. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
- G. ASME B16.3 - Malleable Iron Threaded Fittings
- H. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250
- I. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings
- J. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
- K. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings - DWV
- L. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes
- M. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
- N. ASME B16.32 - Cast Copper Alloy Solder-Joint Fittings for Solvent Drainage Systems
- O. ASTM A47 - Ferritic Malleable Iron Castings
- P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
- Q. ASTM A74 - Cast Iron Soil Pipe and Fittings

- R. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
- S. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- T. ASTM B32 - Solder Metal
- U. ASTM B42 - Seamless Copper Pipe
- V. ASTM B43 - Seamless Red Brass Pipe
- W. ASTM B75 - Seamless Copper Tube
- X. ASTM B88 - Seamless Copper Water Tube
- Y. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube
- Z. ASTM B302 - Threadless Copper Pipe (TP)
- AA. ASTM B306 - Copper Drainage Tube (DMV).
- BB. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe
- CC. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
- DD. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
- EE. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- FF. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- GG. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings
- HH. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
- II. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- JJ. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings

- KK. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- LL. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping
- MM. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe
- NN. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- OO. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
- PP. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.
- QQ. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- RR. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- SS. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- TT. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- UU. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
- VV. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Pipe
- WW. AWS A5.8 - Brazing Filler Metal
- XX. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids
- YY. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
- ZZ. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings

AAA. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

BBB. AWWA C651 - Disinfecting Water Mains

CCC. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems

DDD. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems

EEE. CAN-3 B281 - Aluminum Drain, Waste, and Vent Pipe and Components

FFF. NCPWB - Procedure Specifications for Pipe Welding

GGG. NFPA 54 - National Fuel Gas Code.

HHH. NFPA 58 - Storage and Handling of Liquified Petroleum Gases

1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

#### 1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 15010.

B. Record actual locations of valves.

#### 1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 15010.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.7 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME Sec 9 NCPWB Standard Procedure Specifications.
- D. Maintain one copy of each document on site.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 3 years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

#### 1.9 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State, Local, SPCC, NFPC, UPC and BOCA plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.



### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding are wet or frozen.

### 1.12 EXTRA MATERIALS

- A. Furnish under provisions of Section 01700.
- B. Provide two repacking kits for each size valve.

## PART 2 PRODUCTS

### 2.1 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: ASTM A74, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: ASTM C564, neoprene gasket system or lead and oakum.
  - 3. Aluminum DMV Pipe: CAN-3 B281, ASSE 1045-87 coated.
    - a. Fittings: Cast iron
    - b. Joints: CISPI 310, thermoplastic rubber coupling and stainless steel clamps.

### 2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
  - 1. Fittings: Cast iron
  - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: ASTM C564, neoprene gasket system or lead and oakum.
- C. Aluminum DWV Pipe: CAN-3 B281 ASSE 1045-87 coated.
  - 1. Fittings Cast iron

2. Joints: CISPUR 310, thermoplastic rubber coupling and stainless steel clamps.

D. Copper Tubing: ASTM B306, DWV

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
2. Joints: ASTM B32, solder, Grade 50B.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight

1. Fittings: Cast iron
2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Aluminum DWV Pipe: CAN 3-B281

1. Fittings: Cast iron
2. Joints: ASTM C564, CISPI 310, thermoplastic rubber coupling and stainless steel clamps.

D. Brass Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR-26 for not less than 150 psig pressure rating.

1. Fittings: ASTM D2466, PVC.
2. Joints: ASTM D2855, solvent weld with ATM D2564 Solvent cement.

2.4 WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Tubing: ASTM B88, Type K hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

B. Copper Tubing: ASTM B88, Type K annealed.

1. Fittings: ASME B16.26, cast bronze

2. Joints: Flared.

2.5 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.

2. Joints: ASTM B32, solder, Grade 95TA.

Do not install any plastic piping in ceiling or wall spaces that are used for HVAC supply or return air.

2.6 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74, service weight

1. Fittings: Cast iron

2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. PVC Pipe: ASTM D2729

1. Fittings: PVC

2. Joints: ASTM D2855, solvent weld.

2.7 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

- 2.8 NATURAL GAS PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING
  - A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.
    - 1. Fittings: ASTM A234, forged steel welding type, with AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
    - 2. Joints: ANSI B31.1, ANSI B31.2, ANSI B31.9, ASME Sec 1, welded.
  - B. Polyethylene Pipe: ASTM D2513, SDR 11.5.
    - 1. Fittings: ASTM D2683 or ASTM D2513 socket type.
    - 2. Joints: Fusion welded
- 2.9 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING
  - A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.
    - 1. Fittings: ASTM A234, forged steel welding type, with AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
    - 2. Joints: ANSI B31.1, ANSI B31.2, ANSI B31.9, ASME Sec 1, welded.
- 2.10 NATURAL GAS PIPING, ABOVE GRADE
  - A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.
    - 1. Fittings: ASTM b16.3, MALLEABLE IRON OR ASTM 234, forged steel welding type.
    - 2. Joints: NFPA 54, threaded or welded to ANSI B31.1, ANSI B31.2, ANSI B31.9, ASME Sec 1.
- 2.11 FLANGES, UNIONS, AND COUPLINGS
  - A. Pipe Size 2 Inches (50 mm) and Under:
    - 1. Ferrous pipe: 150 psig (1 034 kPa) malleable iron threaded unions.

B. Pipe Size Over 2 Inches (50 mm):

1. Ferrous pipe: 150 psig (1 034 kPa) forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.12 GATE VALVES

A. Acceptable Manufacturers:

1. Nibco Model T111
2. Hammond Valve Corp. Model 1B640
3. Stockham Model B-100
4. Crane Model 1700
5. Approved equal under provisions of Divisions 0 and 1.

B. Up to and including 3 inches (50 mm): Bronze body, bronze trim, rising stem handwheel, inside screw, single wedge or disc, solder or threaded ends.

C. Over 3 inches (50 mm): Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged.

2.13 GLOBE VALVES

A. Acceptable Manufacturers:

1. Nibco Model T235-N
2. Hammond Valve Corp. Model 1B640
3. Stockham Model B-100
4. Crane Model 1700
5. Approved equal under provisions of Divisions 0 and 1.

B. Up to and including 2 inches (50 mm): Bronze body, bronze trim, rising stem, handwheel, inside screw, renewable composition disc, solder or threaded ends, with back seating capacity (repackable under pressure).

- C. Over 2 inches (50 mm): Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

#### 2.14 BALL VALVES

##### A. Acceptable Manufacturers

1. Nibco Model T-580
2. Hammond Model 8201
3. Approved equal under provisions of Divisions 0 and 1.

- B. Up to and including 2 inches (50 mm): Bronze two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, solder ends.

- C. Over 2 inches (50 mm): Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

#### 2.15 PLUG VALVES

##### A. Acceptable Manufacturers:

1. Rockell Model 114, 142 and 143.
2. Approved equal under provisions of Divisions 0 and 1.

- B. Up to and including 2 inches (50 mm): cast iron tapered plug, lubricated, teflon washer, threaded ends.

- C. Over 2 inches (50 mm): Cast iron body and plug, lubricated, teflon washer, flanged ends.

#### 2.16 FLOW CONTROLS (BALANCING)

##### A. Acceptable Manufacturers:

1. Hammond Model 208.
2. Approved equal under provisions of Divisions 0 and 1.

- B. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet.

- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum

pressure required for control, minimum pressure 3.5 psig (24 kPa).

## 2.17 SWING CHECK VALVES

### A. Manufacturers:

1. Hammond Model Series IB900.
2. Approved equal under provisions of Divisions 0 and 1.

B. Up to and including 2 inches (50 mm): Bronze body, bronze swing disc, solderscrewed ends.

C. Over 2 inches (50 mm): Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

## 2.18 WATER PRESSURE REDUCING VALVES

### A. Acceptable Manufacturers:

- |  |             |
|--|-------------|
| 1. Watts   | Model 9095  |
| 2. Hersey  | Model FRPII |
| 3. Febco   | Model 825Y  |
| 4. Approved equal under provisions of Divisions 0 and 1. |             |

B. Up to 2 Inches (50 mm): Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, double union ends.

C. Over 2 Inches (50 mm): Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

## 2.19 STRAINERS

### A. Acceptable Manufacturers

1. Watts
2. Mueller
3. Wilkins
4. Approved equal under provisions of Divisions 0 and 1.

- B. Size 2 inch (50 mm) and Under: Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

## PART 3 EXAMINATION

### 3.1 EXECUTION

- A. Prior to submitting bid, visit the site of the proposed construction and thoroughly investigate existing utilities, working conditions to be encountered etc. No additional compensations shall be allowed for conditions increasing cost which were not known when submitting proposal if the condition was obvious and could have been discovered during a site visit.

### 3.2 PREPARATION

- A. Excavation
  1. Perform all excavating as required to make plumbing installation. Establish all lines and elevations prior to opening trenches and be responsible for correctness thereof.
  2. Where trenches are excavated to grade such that the bottom of the trench forms the bed for the pipe, a solid and continuous bearing shall be provided between joints, and bell holes shall be provided at points where the pipe is joined, and the pipe shall not be supported on blocks to grade.
  3. Where trenches are excavated below grade such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to grade with sand or fine gravel placed in layers of 6 inches (152 mm) maximum depth and compacted after each placement. Where rock is encountered in trenching, it shall be removed to a minimum of 3 inches (76 mm) below the grade line of the trench, and the trench shall be backfilled to grade with sand tamped in place so as to provide a uniform bearing for the pipe between joints. The pipe shall not rest on rock at any point including the joints.
  4. If soft materials of poor bearing qualities are found at the bottom of the trench, stabilization shall be



achieved by over excavating a minimum of two pipe diameters and bringing up to grade with fine gravel or crushed stone or a concrete foundation. Such a concrete foundation shall be bedded with sand tamped in place so as to provide a uniform bearing for the pipe between joints.

B. Backfilling

1. Loose earth, free of rocks, broken concrete, frozen chunks and other rubble, shall be placed in the trench in 6-inch layers and tamped in place. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that it retains alignment.

C. Pipe Preparation

1. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.]
2. Remove scale and dirt, on inside and outside, before assembly.
3. Prepare piping connection to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08305.

- I. All piping installed in walls or attic spaces that are subject to freezing conditions shall be protected from freezing with heat tape and insulation.
- J. After pipe joints have "set" and test has indicated leakproof installation, any water in trench shall be removed and backfill shall be brought to required grade.
- K. All water and sewer lines shall be installed below freeze line, with water piping buried a minimum of 24 inches.
- L. Provide all sheathing and bracing, using the proper materials, where necessary for the work involved.
- M. Maintain all excavations required herein free of standing water.
- N. After all backfilling has been completed, remove all surplus excavation material from the Owner's property.
- O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- P. Provide support for utility meters in accordance with requirements of utility companies.
- Q. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 09900.
- R. Excavate in accordance with Sections 02222 and 02225 for work of this Section.
- S. Backfill in accordance with Sections 02223 and 02225 for work of this Section.
- T. Install bell and spigot pipe with bell end upstream.
- U. Install valves with stems upright or horizontal, not inverted.
- V. Provide one plug valve wrench for every ten plug valves sized 2 inches (150 mm) and smaller, minimum of one. Provide each plug valve sized 2-12 inches ([60] mm) and larger with a wrench with set screw.
- W0 Pipe vents from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

### 3.4 APPLICATION

- A0 Use grooved mechanical couplings and fasteners only in accessible locations.
- B0 Install unions downstream of valves and at equipment or apparatus connections.
- C0 Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D0 Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 14 inch water column (3.48 kPa). Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

END OF SECTION



SECTION 15430  
PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Floor drains.
- B. Cleanouts.
- C. Hose bibs.
- D. Hydrants.
- E. Water hammer arrestors.
- F. Interceptors.

1.2 ~~[Deleted]PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION~~

- ~~A. Section 01010 - Summary of Work: Owner furnished equipment.~~

1.3 RELATED SECTIONS

- A. Section 15410 - Plumbing Piping.
- B. Section 15440 - Plumbing Fixtures.
- C. Section 15450 - Plumbing Equipment.

1.4 REFERENCES

- A. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- B. ANSI A112.21.1 - Floor Drains.
- C. ANSI A112.26.1 - Water Hammer Arrestors.
- D. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- E. PDI WH-201 Water Hammer Arresters.

1.5 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Manufacturer's Certificate: Certify that grease interceptors meet or exceed specified requirements.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of equipment, cleanouts, backflow preventers grease traps.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Operation Data: Indicate frequency of treatment required for interceptors.
- C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Accept specialties on site in original factory packaging. Inspect for damage.

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Section 01700.
- B. Provide two sets of loose keys and service kit for backflow preventers.

- C. Provide two extra keys for fire hydrants and 10 extra keys for hose bibs.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturers:

- 1. Wade
  - a) Josam
  - b) J. R. Smith
  - c) Zurn
- 2. Model Numbers noted on plans.
- 3. Approved equal under provisions of Divisions 0 and 1.

### 2.2 FLOOR DRAINS

- A. FD-1: ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- B. FD-2: Same as FD-1 except with removable perforated sediment bucket and square strainer.
- C. FD-3: Same as FD-1 except with polished bronze funnel type strainer.
- D. FD-4: Same as FD-1 except with extra heavy duty strainers.
- E. FD-5: Same as FD-1 except with extra heavy duty strainers with hinged grate and sediment bucket.
- F. FD-6: Lacquered cast iron two piece body with drainage flange, heavy duty grate 12 inches wide, 24 inches long, dome strainer, end plates with gaskets.

### 2.3 FLOOR SINKS

- A. FS-1: Lacquered cast iron body with dome strainer and seepage flange.
- B. FS-2: Square lacquered cast iron body with integral seepage pan, epoxy coated interior, dome strainer, sediment bucket,

epoxy coated, nickel bronze frame and grate.

## 2.4 CLEANOUTS

- A. Exterior Areas: Square cast nickel bronze access frame and non-skid cover.
- B. Interior Finished Floor Areas: Lacquered cast iron, two piece body with flange, round with scoriated cover in service areas and round or square with depressed cover to accept floor finish in finished floor areas.
- C. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- D. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

## 2.5 HOSE BIBBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated with lockshield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.
- B. Interior Mixing: Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated with handwheels, and vacuum breaker in conformance with ANSI/ASSE 1011.

## 2.6 HYDRANTS

- A. Non-Freeze Wall Hydrant:
  - 1. Acceptable Manufacturers
    - a. Wade - Model 8620
    - b. Josam - Model 71050
    - c. Woodford - Model 65P
    - d. Zurn - Model Z-1310
  - 2. Approved equal under provisions of Divisions 0 and 1.
- B. Non-Freeze Wall Hydrant: ANSI/ASSE 1019; non-freeze, self-draining type with polished bronze wall plate hose



thread spout, lockshield and removable key, and integral vacuum breaker.

2.7 RECESSED VALVE BOX

- A. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.8 BACK WATER VALVES

- A. BACK WATER VALVES

- 1. Acceptable Manufacturers

- a. Wade - Model W4200
    - b. Zurn - Model Z-1088
    - c. Josam - Model 67300 Series

- 2. Approved equal under provisions of Divisions 0 and 1.

- B. ANSI A112.21.2; cast iron body and cover, brass valve, access cover, extension sleeve and cover.

2.9 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors

- Acceptable Manufacturers

- a. Wade - Size to suit condition.
    - b. Josam - Size to suit condition
    - c. Zurn - Model 2-1310 condition
    - d. Approved equal under provisions of Divisions 0 and 1.

- B. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psig (1700 kPa) working pressure.

2.10 NEUTRALIZATION TANK

- A. Enfield polypropylene neutralization tank, rotationally molded and seamless construction with threaded EZ Access cover assembly as supplied by Enfield Industrial Corp. Tank shall be Neutratan No. EZ005 having a 5 gallon capacity,

complete with 1-1/20 inlet and outlet and 10 vent connection. Tank to be 110 diameter x 140 high.

- B. Neutralization Agents: Each of the above tanks shall require approximately 50 pounds of approved neutralization agent such as limestone or marble chips, one to three inches in size.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Pipe relief from back flow preventer to nearest drain.
- E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories and sinks.
- F. Furnish and install approved neutralization agent. Fill the neutralization tank prior to operation with limestone or marble chips, one to three inches in size, to a level just below the tank outlet. Water shall be added to the tank per manufacturer's recommendations after placement of neutralization agent.

END OF SECTION

SECTION 15440  
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Service sinks.
- F. Electric water coolers.
- G. Showers.
- H. Emergency showers.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 01010 - Summary of Work: Owner furnished fixtures.

1.3 RELATED SECTIONS

- A. Section 06410 - Custom Casework: Preparation of counters for sinks.
- B. Section 06410 - Custom Casework: Lavatory tops.
- C. Section 07900 - Joint Sealers: Seal fixtures to walls and floors.
- D. Section 15140 - Supports and Anchors.
- E. Section 15410 - Plumbing Piping.
- F. Section 15430 - Plumbing Specialties.
- G. Section 15450 - Plumbing Equipment.

1.4 ~~[Deleted]ALLOWANCES~~

- ~~A. Cash Allowance: Include under provisions of Section 01019.~~
- ~~B. Allowance includes purchase and delivery of owner selected fixtures. Installation is included in this section and is part of the Contract Sum/Price.~~

1.5 REFERENCES

- A. ANSI/ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI/ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI/ASME A112.19.2 - Vitreous China Plumbing Fixtures.
- E. ANSI/ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- F. ANSI/ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).
- G. IAPMO/ANSI Z124.1 - Plastic Bathtub Units.
- H. IAPMO/ANSI Z124.2 - Plastic Shower Receptors and Shower Stalls.
- I. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
- J. ANSI/ARI 1010 - Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers.

1.6 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Manufacturer's Installation Instructions.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section [01600.]
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings and instructed by the manufacturer.
- B. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

PART 2 PRODUCTS

2.1 Water Closet (WC-1)

A. Acceptable Manufacturers

1. Water Closet and Seat

- a. American Standard Model 2477.016
- b. Eljer Model 111.1405
- c. Crane Model 3-446
- d. Kohler Model K-4430-ET
- e. Approved equal under provisions of Divisions 0 and 1.

- B. ANSI/ASME A112.19.2; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch (38 mm) top spud, stainless steel china bolt caps.

C. Flush Valve

1. Acceptable Manufacturers

- a. Sloan Regal Model 115-YB-YC-1.6
  - b. Zurn Model Z-6000-2
  - c. Delaney Model 4.14-T8
  - e. Approved equal under provisions of Divisions 0 and 1
2. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.6 gpm flush volume.

D. Seat

- 1. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Wall Mounted Carrier

1. Acceptable Manufacturers

- a. Wade Division/Tyler Pipe Model W-340
- b. Josam Manufacturing Co. Model 12000
- c. Jay R. Smith Mfg Co. Model 270, 280
- d. Zurn Industries, Inc. Model Z-1204-1, Z-1204-2
- e. Approved equal under provisions of Divisions 0 and 1

2. ANSI/ASME A112.6.1; adjustable non-adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.2 WATER CLOSET (WC-1A)

- A. Same as WC-1 except install per handicapped requirements.

2.3 URINAL (UR-1)

A. Urinal

1. Acceptable Manufacturers

- a) American Standard - Model 6501.010
- b) Kohler Co. - Model K-4960-T
- c) Approved equal under provisions of Divisions 0 and 1

2. ANSI/ASME A112.19.2; vitreous china, wall hung siphon jet urinal with shields, integral trap, 3/4 inch (top spud, steel supporting hanger.

B. Flush Valve

1. Acceptable Manufacturers:

2. Other acceptable manufacturers offering equivalent products.

- a) Sloan Model 186-YB-YC-1.
- b) Zurn Model Z-6003
- c) Delaney Model 451
- d) Approved equal under provisions of Divisions 0 and 1

3. ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop ,vacuum breaker; maximum 1 gpm (4 L) flush volume.

2.4 URINAL (UR-2)

A. Same as UR-1 except installed per handicapped requirements.

2.5 LAVATORY

A. Acceptable Manufacturers

Lavatory 4" Centers

- a. American Standard Model 0496.011
- b. Eljer Model 051-3370
- c. Kohler Model K-22257
- d. Approved equal under provisions of Divisions 0 and 1.

Faucet and Brass

	Faucet Model Series	PTrap Model	Supply Stop Model
a. American Standard	2385.002	4402.012	2306.017
b. Eljer	557-1062(Grid Drain)	804-1185	802-0310
c. Kohler	K15198	K-9006	K-7600
d.	Approved equal under provisions of Divisions 0 and 1.		

B. L-1

1. ANSI/ASME A112.19.2; vitreous china self-rimming counter top lavatory, (refer to plans for size) with drillings on 4 (100 mm) centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket.

C. Trim

1. ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator, single lever handle, (min 4" (1.3 mm) long handle) chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2.6 SINK

A. Acceptable Manufacturers

	Model Single Compartment	Model Double Compartment
1. Just	SL-2222-A-Gr	DLX-1829-A-GR
2. Elkay	LR-2222	LR-2918
3.	Approved equal under provisions of Divisions 0 and 1.	



Faucet and Brass Manufacturer	Faucet Model	Strainer Model	PTrap Supply Model Stop	Model
a. Just	J-902	J-35	-	-
b. Elkay	LK-4103	LK-99	-	-
c. McGuire	-	151-A	8912	2167LK
d. Engineered Brass Co.	-	SB8C	TA150LA13	
e. Approved equal under provisions of Divisions 0 and 1.				

Faucet and Brass	Faucet Model	Strainer Model	PTrap Supply Model Stop	Model
a. American Standard		2411.015	4402.012	2306.017
b. Eljer		803-0552	804-1185	802-0310
c. Crane		8-5222	8-5260	8-5000
d. Kohler		K-7715	K-9006	K-7600
e. McGuire		1SS-A	8872	158
f. Engineered Brass Co.		SG 7	TA125LA10	
g. Approved equal under provisions of Divisions 0 and 1.				

B. S-1

1. ANSI/ASME A112.19.3; double compartment (Refer to plans for size), 20 gage (0.9 thick, Type 304 stainless steel, self-rimming with undercoating, 3-1/2 inch (90 mm) crumb cups, and stainless steel drain, ledge back drilled for trim.

C. Trim

1. ASME A112.18.1; chrome plated brass supply with swing spout, water economy aerator, single lever handle and retractable spray; chrome plated 17 gage (1.3 mm) brass P-trap with clean-out plug and arm with escutcheon.

D. Trim (Additional Trim for Photo Lab 153 Only)

1. Complete factory assembled exposed photo mixing system equal to Leonard TN-456 Photomaster with thermostatic mixing valve, integral checkstop, union connections, outlet volume control/shutoff, dial thermometer (25 deg. To 125 deg. F, 0 deg to 50 deg. C), vacuum breaker and chrome plated piping. Provide escutcheon for wall penetration.

2.7 SH-1 SHOWER

A. Cabinet

1. ANSI Z124.2 reinforced glass fiber, 32 x 32 x 75 inch (800 x 800 x 1900 mm) high, with receptor, soap dish, removable chrome plated strainer, tail piece, color as selected by Architect.

B. Trim

1. ASME A112.18.1; concealed shower supply with indexed handles, bent shower arm with [flow control and] [adjustable spray] ball joint shower head and escutcheon.
2. ASME A112.18.1; concealed shower supply with pressure balanced thermostatic mixing valves, bent shower arm with flow control and adjustable spray ball joint shower head and escutcheon.

C. Shower Head

1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 2-1/2 gal/min (0.2 L/sec) flow control.

D. Acceptable Manufacturers

1. Symmons Industries
2. Leonard Valve Co.
3. Bradley Corp.
4. Approved equal under provisions of Divisions 0 and 1.

2.8 SH-2 GANG SHOWER:

A. ACCEPTABLE MANUFACTURERS

- a. Bradley Corporation Model No. 6CO
- b. Acorn Manufacturing Model No. classic 600 series
- c. Approved equal under provisions of Divisions 0 and 1.

B. Complete chrome plated unit for 6 users, 304 16 gauge stainless steel column with No. 4, screw type adjustable spray shower head set at 2.5 gpm maximum flow @ 80 psi minimum pressure, locking feature on spray head and corrosion resistant orifice.

C. Drain shall be integral with column at base with dome grate, top fed domestic cold water, hot water and sanitary vent.

2.9 ELECTRIC WATER COOLER

A. Fountain

1. Acceptable Manufacturers:

- a) Sun Roc Model HCW C8
- b) Halsey Taylor Model HAC 8EE
- d) Approved equal under provisions of Divisions 0 and 1.

2. ANSI/ARI 1010; surface handicapped mounted electric water cooler with stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, infra-red control, mounting bracket, refrigerated with integral air cooled condenser.

- a) Capacity: 8 gpm (0.5 L/s) of 50 degree F (10 degree C) water with inlet at 80 degree F (27 degree C) and room temperature of 90 degree F (32 degree C).
- b) Electrical: Maximum 1/5 hp, 6 FLA compressor, 6 foot (2 m) cord and plug for connection to electric wiring system including grounding connector.

2.10 MOP BASIN  
SERVICE SINK MB-1

A. Bowl

1. Acceptable Manufacturers:
  - a. Fiat Products                      Model SB-2424
  - b. Stern/Williams                      Model EB-54
  - c. Approved equal under provisions of Divisions 0 and 1.
2. ANSI/ASME A112.19.1; 24 x 24 x 6 inch (560 x 460 x 300 mm) deep, Terrazzo chrome plated strainer.

B. Trim

1. Acceptable Manufacturers:
  - a. American Standard                      Model 8341.075
  - b. Eljer                                      Model 749-1370
  - c. Crane                                      Model C 5051
  - d. Kohler                                      Model K-8906
  - e. Approved equal under provisions of Divisions 0 and 1.
2. ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges; 5 feet (1.5 m) of 2 inch (13 mm) diameter plain end reinforced rubber hose, hose clamp, mop hanger.

2.11 EMERGENCY SHOWER (ESH-1)

A. Acceptable Manufacturers:

- a. Haws                                      Model 8346
- b. Western                                      Model 9221
- c. Bradley                                      Model 519-310 P
- d. Approved equal under provisions of Divisions 0 and 1.

- B. ANSI Z358.1; free standing, self- cleaning, non-clogging 8 inch (200 mm) diameter plastic deluge shower head with elbow, one inch (25 mm) full flow valve with pull rod and handle, one inch and one quarter interconnecting fittings, emergency light and horn; (activated on flow), ANSI Z358.1; self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.

### 3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with wheel stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with [wall carriers] and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07900.
- G. Solidly attach water closets to floor mounted carrier.

### 3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

- A. Adjust work under provisions of Section 01700.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean work under provisions of 01700.
- B. At completion clean plumbing fixtures and equipment.

3.7 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01500.
- B. Do not permit use of fixtures.

3.8 FIXTURE HEIGHTS

- A. Install fixtures to heights above finished floor as indicated.
- B. Water-Closet
  - 1. Standard 15 inches (380 mm) to top of bowl rim.
  - 2. Handicapped per ADA requirements.
- C. Urinal
  - 1. Standard 22 inches (560 mm) to top of bowl rim.
  - 2. Handicapped per ADA requirements.
- D. Lavatory
  - 1. Standard 31 inches (785 mm) to top of basin rim.
  - 2. Handicapped per ADA requirements.
  - 3. In vanity top: 34".
- E. Drinking Fountain
  - 1. Standard 30 inches 760 mm to top of basin rim.
  - 2. Handicapped per ADA requirements.

F. Water Closet Flush Valves

1. Standard 11 inches (280 mm) min. above bowl rim.

G. Shower Heads

1. Per ADA requirements.

H. Emergency Eye And Face Wash

1. Standard 38 inches (965 mm) to receptor rim.

I. Emergency Shower

1. Standard 84 inches (2130 mm) to bottom of head.

3.9 FIXTURE ROUGH-IN SCHEDULE

	<u>Hot Water</u>	<u>Cold Water</u>	<u>Waste</u>	<u>Vent</u>
Lavatory:	2 inch (13 mm)	2 inch (13 mm)	1-1/4 inch (38 mm)	2 inch (32 mm)
Service Sink:	2 inch (13 mm)	2 inch (13 mm)	3 inch (75 mm)	2 inch (38 mm)
Sink:	2 inch (13 mm)	2 inch (13 mm)	1-1/2 inch (38 mm)	2 inch (32 mm)
Drinking Fountain:		2 inch (13 mm)	1-1/4 inch (32 mm)	2 inch (32 mm)
Water Closet (Flush Valve):		1 inch (25 mm)	4 inch (100 mm)	2 inch (50 mm)
Urinal (Flush Valve):		3/4 inch (19 mm)	2 inch (50 mm)	2 inch (38 mm)

3.10 EXPOSED PIPES AND SURFACES

- A. Hot water and drain pipes under lavatories shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories. Undersink protective pipe covers shall be equal to Lav Guard or approved equal.

END OF SECTION





SECTION 15450  
PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters.
- B. Pumps.

1.2 RELATED SECTIONS

- A. Section 15140 - Supports and Anchors.
- B. Section 15242 - Vibration Isolation.
- C. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

- A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
- B. ASME Section VIIIID - Pressure Vessels; Boiler and Pressure Vessel Codes.
- C. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- D. ANSI/NFPA 54 - National Fuel Gas Code.
- E. ANSI/NFPA 70 - National Electrical Code.
- F. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- G. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).
- H. ASTM A123 - 1978 zinc (Hot-Galvanized) Coatings on Products
- I. MSS SP 80 - 1974 Bronze Gate, Globe, Angle, and Check Valves

1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall

be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

A. Shop Drawings:

1. Include heat exchanger dimensions, size of tappings, and performance data.
2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

B. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State and Local Codes.
- B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
1. American Gas Association (AGA).

2. National Sanitation Foundation (NSF).
  3. American Society of Mechanical Engineers (ASME).
  4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
  5. National Electrical Manufacturers' Association (NEMA).
  6. Underwriters Laboratories (UL).
- D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to AGA, NSF, NBBPVI, ANSI/NFPA 54, ANSI/NFPA 58, ANSI/NFPA 70, ANSI/UL 174, and ANSI/UL 1453 requirements for water heaters.
- B. Conform to ASME Section VIIIID for manufacture of pressure vessels for heat exchangers.
- C. Conform to ASME Section VIIIID, ANSI/NFPA 30, and ANSI/NFPA 31 for tanks.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

#### 1.9 WARRANTY

- A. Provide five year warranty under provisions of Section 01700.
- B. Warranty: Include coverage of domestic water heaters, and in-line circulator.

#### 1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 01700.

PART 2 PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATER

A. Manufacturers:

1. PVI.
2. Sellers.
3. Aerco.
4. Approved equal under provisions of Divisions 0 and 1.

B. Type: Automatic, natural gas-fired, vertical storage.

C. Performance:

1. Storage: 225 gal (851.6 L) capacity.
2. Input: 800,000 Btuh (234.4 kW)
3. Minimum recovery rate: 100 gph (0.105 L/s) with 100 degrees F (38 degrees C) temperature rise.
4. Maximum working pressure: 150 psig (1000 kPa)

D. Tank: Copper lined welded steel; multiple flu passages, 4 inch (100 mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

F. Approval: By AGA as automatic storage water heater.

G. Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 175 degrees F (97 degrees C) differential, automatic reset high temperature limiting thermostat, factory set at 205 degrees F (96 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shut down of pilot and main burner in 2-4 seconds after loss of flame, and automatic flue damper.

H. Thermal efficiency shall be a minimum of 83%.

## 2.3 IN-LINE CIRCULATOR PUMPS

A. Acceptable Manufacturers:

1. Grundfos.
2. Armstrong.
3. Approved equal under provisions of Divisions 0 and 1.

B. Performance:

1. Flow: 20 gpm (1.26 L/s), at 10 feet (29.8 kPa) head.
2. Electrical Characteristics:
  - a) 1.0 hp (0.746 kW).
  - b) 208 volts, three phase, 60 Hz.

C. Casing: Bronze, rated for 125 psig (860 kPa) working pressure.

D. Impeller: Bronze.

E. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

F. Seal: Carbon rotating against a stationary ceramic seat.

G. Drive: Flexible coupling.

## 2.4 VALVES AND OTHER PIPING ACCESSORIES

A. Gate Valves

1. Valves Smaller Than 3-Inch Size

MSS SP 80, double disc, parallel seat, inside screw rising stem, with a water pressure rating of 200 psig. Valves shall have flanged or threaded end connections, with a union on one side of the valve.

B. Check Valves Smaller Than 3-Inch Size

Mil. Spec. MIL-V-18436. Valves shall have threaded end connections. Mil. Spec. MIL-V-18436 valves shall be swing check, cast-iron or steel bodies with bronze trim, and designed for a hydraulic working pressure of 185 psig.

Check Valves shall be equipped with a limit switch to sense pump discharge.

C. Valve Boxes

Provide for each valve on buried piping. Valve boxes shall be of cast iron or precast concrete unless indicated otherwise. Size shall be suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "SEWER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Each cast-iron box shall have a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install water heaters in accordance with manufacturer's written instructions and to AGA, NSF, ANSI/NFPA 54, and UL requirements.
- B. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.

3.2 PUMP INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
- C. Support piping adjacent to pump such that no weight is carried on pump casings.
- D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 15510  
HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:

1. Heating water piping system.
2. Equipment drains and overflows.

B. Valves:

1. Gate valves.
2. Globe or angle valves.
3. Ball valves.
4. Plug valves.
5. Butterfly valves.
6. Check valves.

1.2 RELATED SECTIONS

- A. Section 08305 - Access Doors.
- B. Section 09900 - Painting.
- C. Section 15121 - Piping Expansion Compensation.
- D. Section 15190 - Mechanical Identification.
- E. Section 15245 - Vibration Isolation.
- F. Section 15260 - Piping Insulation.
- G. Section 15515 - Hydronic Specialties.
- H. Section 15545 - Chemical Water Treatment: Pipe cleaning.
- I. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS

(Latest Edition or Revision)

- A. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Braising Operators.
- B. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B31.9 - Building Services Piping.
- F. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- G. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- H. ASTM B32 - Solder Metal.
- I. ASTM B88 - Seamless Copper Water Tube.
- J. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- K. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
- L. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
- M. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.
- N. ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- O. ASTM D2467 - Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- P. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite-Sewer Piping.



- Q. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- R. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- S. ASTM D2855 - Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- T. ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.
- U. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- V. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- W. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Tubing.
- X. ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.
- Y. ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.
- Z. AWS A5.8 - Brazing Filler Metal.
- AA. AWS D1.1 - Structural Welding Code.
- BB. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- CC. AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
- DD. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- EE. AWWA C151 - Ductile-Iron Pipe,Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- FF. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
- GG. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- HH. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

- II. ASTM A 47 Specification for Ferritic Malleable Iron Castings
  - JJ. ASTM A 126 Specification for Gray Iron Castings for Valves, Flanges, & Pipe Fittings
  - KK. ASTM A 536 Specification for Ductile Iron Castings
  - LL. ASTM D 2564 Specification for Solvent Cements for PVC Plastic Pipe & Fittings
  - MM. ASTM D2661 Specification For Acrylonitrile - Butadiene - Styrene (ABS) Schedule 40 Plastic Drain, Waste, & Vent Pipe & Fittings
  - NN. ASTM D 2672 Specification for Joints for IPS PVC Pipe Using Solvent Cement
  - OO. ASTM D 2846 Specification For CPVC Plastic Hot & Cold Water Distribution Systems
  - PP. ASTM D 3138 Specification for Solvent Cements for Transition Joints Between ABS & PVC Non-Pressure Piping Components
  - QQ. ASTM F 402 Practice For Safe Handling Of Solvent Cements, Primers, & Cleaners Used For Joining Thermoplastic Pipe & Fittings
  - RR. ASTM F 493 Specification For Solvent Cements For CPVC Plastic Pipe & Fittings
  - SS. ASME B1.20.1 Pipe Threads, General Purpose
  - TT. ASME B16.20 Ring - Joint Gaskets & Grooves For Steel Pipe Flanges
  - UU. ASME B16.21 Nonmetallic Flat Gaskets For Pipe Flanges
  - VV. ASME B18.2.1 Square & Hex Bolts & Screws
  - WW. AWS Soldering Manual & Brazing Manual
  - XX. AWS D10.12 Recommended Practices & Procedures For Welding Low Carbon Steel Pipe
- 1.4 SYSTEM DESCRIPTION
- A. Where more than one piping system material is specified, ensure system components are compatible and joined to

ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- B. Use grooved mechanical couplings and fasteners in accessible locations.
  - C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
  - D. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
  - E. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.
  - F. Use gate or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
  - G. Use globe or butterfly valves for throttling, bypass, or manual flow control services.
  - H. Use spring loaded check valves on discharge of pumps.
  - I. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
  - J. Use butterfly valves in heating water systems interchangeably with gate and globe valves.
  - K. Use only butterfly valves in chilled water systems for throttling and isolation service.
  - L. Use lug end butterfly valves to isolate equipment.
  - M. Use 3/4 inch (19 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.
- 1.5 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- B. Welders Certificate: Include welders certification of compliance with ASME SEC 9 and AWS D1.1.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of valves.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.
- C. Welders: Certify in accordance with ASME SEC 9 and AWS D1.1.

#### 1.9 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Divisions 0 and 1.
- B. Provide two repacking kits for each size and valve type.

PART 2 PRODUCTS

2.1 HEATING WATER PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53, Schedule 40, black.
  - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
  - 2. Joints: Threaded, or AWS D1.1, welded.
- B. Copper Tubing: ASTM B88, Type L, hard drawn.
  - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

## 2.2 CHILLED WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53, Schedule 40, black with AWWA C105 polyethylene jacket, or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
  1. Fittings: ASTM A234, forged steel welding type with double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.
  2. Joints: AWS D1.1, welded.
  3. Casing: Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.

## 2.3 CHILLED WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53, Schedule 40, black.
  1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type.
  2. Joints: Threaded or AWS D1.1 welded.
- B. Copper Tubing: ASTM B88, Type L, hard drawn.
  1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F (640 - 805 degrees C).

## 2.4 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
  1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F (220 to 280 degrees C).

- B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
  1. Fittings: ASTM D2466 or D2467, PVC.
  2. Joints: ASTM D2855, solvent weld.

## 2.5 PIPE HANGERS AND SUPPORTS

- A. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, MSS SP89.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
- C. Hangers for Cold Pipe Sizes 2 Inches (51 mm) and Over: Carbon steel, adjustable, clevis.
- D. Hangers for Hot Pipe Sizes 2 to 4 Inches (51 to 102 mm): Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (152 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
- H. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
- I. Wall Support for Pipe Sizes 4 Inches (102 mm) and Over: Welded steel bracket and wrought steel clamp.
- J. Wall Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
- K. Vertical Support: Steel riser clamp.
- L. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

- M. Floor Support for Hot Pipe Sizes to 4 Inches (102 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- N. Floor Support for Hot Pipe Sizes 6 Inches (152 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- O. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- P. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- Q. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.6 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches (51 mm) and Under:
  - 1. Ferrous Piping: 150 psig (1030 kPa) malleable iron, threaded.
  - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 Inches (51 mm):
  - 1. Ferrous Piping: 150 psig (1030 kPa) forged steel, slip-on.
  - 2. Copper Piping: Bronze.
  - 3. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene.
- C. Grooved and Shouldered Pipe End Couplings:
  - 1. Housing Clamps: Malleable iron galvanized to engage and lock, designed to permit some angular deflection, contraction, and expansion.
  - 2. Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 degrees F (-34 (degrees C) to 230 degrees F (110 degrees C).
  - 3. Accessories: Steel bolts, nuts, and washers.



- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.7 GATE VALVES

### A. Valves Up To and Including 2 Inches (51 mm):

#### 1. Acceptable Manufacturers:

- a) Grinnell Corp.
- b) Nibco, Inc.
- c) Milwaukee Valve Co.
- d) Stockham, Valves and Fittings, Inc.
- e) Approved equal under provisions of Division 0 and 1.

- 2. Bronze body, bronze trim, screwed bonnet, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

### B. Valves Over 2 Inches (51 mm):

#### 1. Acceptable Manufacturers:

- a) Grinnell Corp.
- b) Nibco, Inc.
- c) Milwaukee Valve Co.
- d) Stockham, Valves and Fittings, Inc.
- e) Approved equal under provisions of Division 0 and 1.

- 2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

## 2.8 GLOBE OR ANGLE VALVES

### A. Valves Up To and Including 2 Inches (51 mm):

#### 1. Acceptable Manufacturers:

- a) Grinnell Corp.

- b) Nibco, Inc.
  - c) Milwaukee Valve Co.
  - d) Approved equal under provisions of Division 0 and 1.
  - 2. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw, renewable composition disc and bronze seat, solder or threaded ends.
- B. Valves Over 2 Inches (51 mm):
- 1. Acceptable Manufacturers:
    - a) Grinnell Corp.
    - b) Nibco, Inc.
    - c) Milwaukee Valve Co.
    - d) Stockham, Valves and Fittings, Inc.
    - e) Approved equal under provisions of Division 0 and 1.
  - 2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

## 2.9 BALL VALVES

- A. Valves Up To and Including 2 Inches (51 mm):
- 1. Acceptable Manufacturers:
    - a) Grinnell Corp.
    - b) Nibco, Inc.
    - c) Milwaukee Valve Co.
    - d) Stockham, Valves and Fittings, Inc.
    - e) Approved equal under provisions of Division 0 and 1.

2. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.

B. Valves Over 2 Inches (51 mm):

1. Acceptable Manufacturers:

- a) Grinnell Corp.
- b) Nibco, Inc.
- c) Milwaukee Valve Co.
- d) Stockham, Valves and Fittings, Inc.
- e) Approved equal under provisions of Division 0 and 1.

2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.10 PLUG VALVES

A. Valves Up To and Including 2 Inches (51 mm):

1. Acceptable Manufacturers:

- a) Homestead Valve Division.
- b) Mueller Steam Specialty Co.
- c) Henry Pratt Co.
- d) Approved equal under provisions of Division 0 and 1.

2. Bronze body, bronze tapered plug, full port opening, non-lubricated, teflon packing, threaded ends.

3. Operator: One plug valve wrench for every ten plug valves minimum of one.

B. Valves Over 2 Inches (51 mm):

1. Acceptable Manufacturers:

- a) Homestead Valve Division.
- b) Mueller Steam Specialty Co.

- c) Henry Pratt Co.
- d) Approved equal under provisions of Division 0 and 1.
- 2. Cast iron body and plug, full port opening, pressure lubricated, teflon packing, flanged ends.
- 3. Operator: Each plug valve with a wrench with set screw.

## 2.11 BUTTERFLY VALVES

### A. Acceptable Manufacturers:

- 1. Grinnell Corp.
- 2. Nibco, Inc.
- 3. Milwaukee Valve Co.
- 4. Stockham, Valves and Fittings Inc.
- 5. Approved equal under provisions of Divisions 0 and 1.

B0 Body: Cast or ductile iron with resilient replaceable EPDM seat, lug ends, and extended neck. Wafer type valves shall not be accepted.

C0 Disc: Aluminum bronze.

D0 Operator: Infinite position lever handle with memory stop.

## 2.12 SWING CHECK VALVES

### A0 Valves Up To and Including 2 Inches (51 mm):

#### 1 Acceptable Manufacturers:

- a0 Grinnell Corp.
- b0 Nibco, Inc.
- c0 Mueller Steam Specialty Co.
- d) Stockham, Valves and Fittings Inc.
- e) Approved equal under provisions Divisions 0 and 1.

- 2 Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.

B0 Valves Over 2 Inches (51 mm):

1 Acceptable Manufacturers:

a0 Grinnell Corp.

b0 Nibco, Inc.

c0 Mueller Steam Specialty Co.

d) Stockham, Valves and Fittings Inc.

e) Approved equal under provisions of Division 0 and 1.

- 2 Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.13 SPRING LOADED CHECK VALVES

A0 Acceptable Manufacturers:

1) Grinnell Corp.

2) Nibco, Inc.

3) Mueller Steam Specialty Co.

4) Stockham, Valves and Fittings Inc.

5) Approved equal under provisions of Divisions 0 and 1.

- B0 Valves shall have iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.1 PREPARATION

A0 Ream pipe and tube ends. Remove burrs.

B0 Remove scale and dirt on inside and outside before assembly.

C0 Prepare piping connections to equipment with flanges or unions.

D0 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E0 After completion, fill, clean, and treat systems. Refer to Section 15545

### 3.2 INSTALLATION

A0 Install in accordance with manufacturer's instructions.

B0 Install heating water piping to ASME B31.9.

C0 Route piping in orderly manner, parallel to building structure, and maintain gradient.

D0 Install piping to conserve building space, and not interfere with use of space.

E0 Group piping whenever practical at common elevations.

F0 Sleeve pipe passing through partitions, walls and floors.

G0 Slope piping and arrange to drain at low points.

H0 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15121.

I0 Inserts:

- 1 Provide inserts for placement in concrete formwork.
- 2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- 3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (102 mm).
- 4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

J0 Pipe Hangers and Supports:

- 1 Install in accordance with ASTM B31.9, ASTM F708 and MSS SP89.
- 2 Support horizontal piping as scheduled.

- 3 Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
  - 4 Place hangers within 12 inches (305 mm) of each horizontal elbow.
  - 5 Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6 Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
  - 7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8 Provide copper plated hangers and supports for copper piping.
  - 9 Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K0 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15260.
- L0 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08305.
- M0 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- N0 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- O0 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09900.
- P0 Install valves with stems upright or horizontal, not inverted.

### 3.3 SCHEDULES

#### A0 Pipe Hanger Spacing.

PIPE SIZE <u>Inches (mm)</u>	HANGER ROD MAX. HANGER SPACING <u>Feet (m)</u>	DIAMETER <u>Inches (mm)</u>
1/2 to 1-1/4 (13 to 32)	6.5 (2.0)	3/8 (10)
1-1/2 to 2 (38 to 51)	10 (3.0)	3/8 (9)
2-1/2 to 3 (64 to 76)	10 (3.0)	1/2 (13)
4 to 6 (102 to 152)	10 (3.0)	5/8 (16)
8 to 12 (203 to 305)	14 (4.3)	7/8 (22)
14 and Over (356 and Over)	20 (6.1)	1 (25)
PVC (All Sizes)	6 (1.8)	3/8 (10)

END OF SECTION



SECTION 15515  
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Strainers.
- E. Pump suction fittings.
- F. Combination fittings.
- G. Flow indicators, controls, meters.
- H. Relief valves.

1.2 RELATED SECTIONS

- A. Section 15430 - Plumbing Specialties: Backflow Preventers.
- B. Section 15510 - Hydronic Piping.
- C. Section 15545 - Chemical Water Treatment: Pipe Cleaning.

1.3 CODES AND STANDARDS (Latest Edition or Revision)

- A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.
- B. ANSI B1.20.1 - Pipe Threads
- C. ANSI 16.1 - Cast-Iron Pipe Flanges & Flanged Fittings, Class 25, 125, 250, and 800
- D. ANSI B16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300.
- E. ANSI B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250.

- F. ANSI B16.5 - Pipe Flanges & Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
  - G. ANSI B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
  - H. ANSI B16.24 - Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.
  - I. ASTM A53 - Specification For Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless
  - J. ASTM B32 - Specification For Solder Metal
  - K. ASTM B88 - Specification For Seamless Copper Water Tube
  - L. ASTM A47 - Specification For Ferritic Malleable Iron Castings
  - M. ASTM A126 - Specification For Gray Iron Castings For Valves, Flanges, & Pipe Fittings
  - N. ASTM A536 - Specification For Ductile Iron Castings
  - O. AWS Soldering Manual and Brazing Manual
  - P. AWS A5.8 - Specification For Filler Metals For Brazing
  - Q. AWS D1.1 - Structural Welding Code For Steel
  - R. AWS D10.12 - Recommended Practices & Procedures For Welding Low Carbon Steel Pipe
- 1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
  - B. Inspection Certificate: Submit inspection certificates for pressure vessels from authority having jurisdiction.
  - C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of valves, flow controls, and flow meters.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Divisions 0 and 1.

## PART 2 PRODUCTS

### 2.1 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Acceptable Manufacturers:
  - a) Armstrong Pumps, Inc.
  - b) Bell & Gossett Corp.
  - c) Taco, Inc.
  - d) Approved equal under provisions of Divisions 0 and 1.
- B. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible, removable butyl diaphragm sealed into tank, and steel support stand.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig (80 kPa).
- D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

### 2.2 AIR VENTS

- A. Manual Air Vent: Short vertical sections of 2 inch (51 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
- B. Automatic Float Type Air Vent:
  - 1. Acceptable Manufacturers:
    - a) Armstrong Pumps, Inc
    - b) Bell & Gossett Corp.
    - c) Taco, Inc.
    - d) Approved equal under provisions of Division 0 and 1.
  - 2. Vents shall have brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type Air Vent.

1. Acceptable Manufacturers:

- a) Armstrong Pumps, Inc.
- b) Bell & Gossett Corp.
- c) Taco, Inc.
- d) Approved equal under provisions of Division 0 and 1.

- 2. Vents shall have brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.3 AIR SEPARATORS

A. Combination Air Separator/Strainer:

1. Acceptable Manufacturers:

- a) ITT Bell & Gossett Corporation.
- b) Taco, Inc.
- c) Armstrong Pumps, Inc.
- d) Approved equal under provisions of Division 0 and 1.

- 2. Air separators shall be steel, tested and stamped in accordance with ASME SEC 8-D; for 125 psig (860 kPa) operating pressure, with integral galvanized steel strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.4 STRAINERS

A. Size 2 inch (51 mm) and Under:

1. Acceptable Manufacturers:

- a) Grinnell Corp.
- b) Metraflex Co.
- c) Armstrong, International, Inc.

- d) Approved equal under provisions of Division 0 and 1.
  - 2. Strainers shall have screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- B. Size 2-1/2 inch (64 mm) to 4 inch (102 mm):
- 1. Acceptable Manufacturers:
    - a) Grinnell Corp.
    - b) Metraflex Co.
    - c) Armstrong, International, Inc.
    - d) Approved equal under provisions of Division 0 and 1.
  - 2. Strainers shall have flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.
- C. Size 5 inch (127 mm) and Larger:
- 1. Acceptable Manufacturers:
    - a) Grinnell Corp.
    - b) Metraflex Co.
    - c) Armstrong, International, Inc.
    - d) Approved equal under provisions of Division 0 and 1.
  - 2. Strainers shall have flanged iron body for 175 psig (1210 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

## 2.5 PUMP SUCTION FITTINGS

- A. Acceptable Manufacturers:
- 1. Armstrong Pumps, Inc.
  - 2. Bell & Gossett Corp.

3. Taco, Inc.

4. Approved equal under provisions of Divisions 0 and 1.

B. Fittings shall have angle pattern, cast-iron body, threaded for 2 inch (51 mm) and smaller, flanged for 2-1/2 inch (64 mm) and larger, rated for 175 psig (1210 kPa) working pressure, with inlet vanes, cylinder strainer with 3/16 inch (5 mm) diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

## 2.6 COMBINATION PUMP DISCHARGE VALVES

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.

2. Bell & Gossett Corp.

3. Taco, Inc.

4. Approved equal under provisions of Divisions 0 and 1.

B. Valves shall have straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psig (1210 kPa) operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

## 2.7 FLOW CONTROLS

A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.

2. Bell & Gossett Corp.

3. Taco, Inc.

4. Approved equal under provisions of Divisions 0 and 1.

B. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum

pressure required for control, maximum minimum pressure 3.5 psig (24 kPa).

- D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.
- E. Accessories: In-line strainer on inlet and ball valve on outlet.

## 2.8 FLOW METERS

### A. Acceptable Manufacturers:

- 1. Armstrong Pumps, Inc.
- 2. Metraflex Co.
- 3. Honeywell, Inc.
- 4. Approved equal under provisions of Divisions 0 and 1.

B. Meters shall have orifice principle by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig (860 kPa) working pressure, with shut off valves, and drain and vent connections.

C. Meters shall be direct reading with insert pitot tube, threaded coupling, for 150 psig (1030 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.

D. Meters shall be cast iron, wafer type, orifice insert flow meter for 250 psig (1720 kPa) working pressure, with read-out valves equipped with integral check valves with gasketed caps.

E. Meters shall be calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

F. Meters shall be cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

G. Portable meters shall consist of case containing one, 3 percent accuracy pressure gage with 0-60 feet (0-180 kPa) pressure range for 500 psig (3450 kPa) maximum working



pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

## 2.9 RELIEF VALVES

### A. Acceptable Manufacturers:

1. Armstrong Pumps, Inc.
2. Amtrol, Inc.
3. ITT McDonnell & Miller.
4. Approved equal under provision of Divisions 0 and 1.

### B. Valves shall have bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- F. Provide valved drain and hose connection on strainer blow down connection.
- G. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

- I. Support pump fittings with floor mounted pipe and flange supports.
- J. Provide relief valves on pressure tanks, low pressure side of reducing valves, and expansion tanks.
- K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- L. Pipe relief valve outlet to nearest floor drain.
- M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION

SECTION 15540

HVAC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. In-line circulators.
- B. Base mounted pumps.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete.
- B. Section 15170 - Motors.
- C. Section 15245 - Vibration Isolation.
- D. Section 15260 - Piping Insulation.
- E. Section 15280 - Equipment Insulation.
- F. Section 15510 - Hydronic Piping.
- G. Section 15515 - Hydronic Specialties.
- H. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. UL 778 - Motor Operated Water Pumps.
- B. NFPA 70 - National Electrical Code.
- C. ASME B16.1 - Cast-Iron Pipe Flanges & Flanged Fittings, Class 25, 125, 250 and 800.
- D. ASTM A36 - Specification For Structural Steel.
- E. ASTM B36 - Specification For Brass Plate, Sheet, Strip, and Rolled Bar.
- F. ASTM B584 - Specification For Copper Alloy Sand Castings For General Applications.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

#### 1.5 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an OFIOO designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
- C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years documented experience.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

#### 1.8 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Divisions 0 and 1..
- B. Provide one set of mechanical seals for each pump.
- C. Provide two sets of cartridges for each side-stream filter.

PART 2. PRODUCTS

2.1 IN-LINE CIRCULATORS

- A. Acceptable Manufacturers:
  - 1. Armstrong Pump Inc.
  - 2. ITT Bell & Gossett.
  - 3. Paco Pumps, Inc.
  - 4. Amtrol, Inc.
  - 5. Weinman Pumps.
  - 6. Aurora Pump.
  - 7. Approved equal under provisions of Divisions 0 and 1.
- B. Type: Pump shall have horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 psig (1210 kPa) maximum working pressure.
- C. Casing: Cast iron, with flanged pump connections.
- D. Impeller: Stamped brass or cast bronze, keyed to shaft.
- E. Bearings: Two, oil lubricated bronze sleeves.
- F. Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.
- G. Seal: Carbon rotating against a stationary ceramic seat, 250 degrees F (121 degrees C) maximum continuous operating temperature.
- H. Drive: Flexible coupling.

I. Electrical Characteristics:

1. Refer to Section 16180.
2. Motor: 1750 rpm unless indicated otherwise; refer to Section 15170.
3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.2 BASE MOUNTED PUMPS

A. Acceptable Manufacturers:

1. Armstrong Pump Inc.
2. ITT Bell & Gossett.
3. Paco Pumps, Inc.
4. Amtrol, Inc.
5. Weinman Pumps.
6. Aurora Pump.
7. Approved equal under provisions of Divisions 0 and 1.

B. Type: Pump shall have horizontal shaft, single stage, direct connected, split casing, for 175 psig (1210 kPa) maximum working pressure.

C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

D. Impeller: Bronze, fully enclosed, keyed to shaft.

E. Bearings: Grease lubricated roller or ball bearings.

F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

G. Seal: Carbon rotating against a stationary ceramic seat, 250 degrees F (121 degrees C) maximum continuous operating temperature.

H. Drive: Flexible coupling with coupling guard.

- I. Baseplate: Cast iron or fabricated steel with integral drain rim.
- J. Electrical Characteristics:
  - 1. Refer to Section 16180.
  - 2. Motor: 1750 rpm unless specified otherwise; refer to Section 15170.
  - 3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

### PART 3. EXECUTION

#### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over. Refer to Section 15245.
- D. Provide line sized shut-off valve and pump suction fitting with integral strainer on pump suction, and line sized soft seat check valve and balancing valve or combination pump discharge valve on pump discharge.
- E. Provide air cock and drain connection on horizontal pump casings.
- F. Provide drains for bases and seals, piped to and discharging into floor drains.
- G. Check, align, and certify alignment of base mounted pumps prior to start-up.

- H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03300.
- I. Lubricate pumps before start-up.

END OF SECTION



SECTION 15545

CHEMICAL WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cleaning of piping systems.
- B. Chemical feeder equipment.
- C. Chemical treatment.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15510 - Hydronic Piping: Placement of water coupon rack, by-pass (pot) feeder.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Owner furnished treatment equipment and chemicals.

1.4 RELATED SECTIONS

- A. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- B. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.5 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. NFPA 70 - National Electrical Code.

1.6 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

- C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- D. Manufacturer's Field Reports: Submit under provisions of Section 15010.
- E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- F. Certificate: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

#### 1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

#### 1.10 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for to public sewage systems.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

#### 1.11 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.
- B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- C. Provide laboratory and technical assistance services during this maintenance period.
- D. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.
- E. Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

#### 1.12 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Divisions 0 and 1.
- B. Provide sufficient chemicals for treatment and testing during warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

A. System Cleaner:

1. Acceptable Manufacturers:

- a) Anderson Chemical Co.
- b) Aqua-Flo, Inc.
- c) Nalco Chemical Co.
- d) Approved equal under provisions of Division 0 and 1.

- 2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
- 3. Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

B. Closed System Treatment (Water):

1. Acceptable Manufacturers:

- a) Anderson Chemical Co.
- b) Aqua-Flo, Inc.
- c) Nalco Chemical Co.
- d) Approved equal under provisions of Division 0 and 1.

- 2. Sequestering agent to reduce deposits and adjust pH [; polyphosphate.
- 3. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
- 4. Conductivity enhancers; phosphates or phosphonates.

## 2.2 BY-PASS (POT) FEEDER

### A. Acceptable Manufacturers:

1. Anderson Chemical Co.
2. Aqua-Flo, Inc.
3. Nalco Chemical Co.
4. Approved equal under provisions of Divisions 0 and 1.

### B. Feeder shall be 5.0 gal (18.9 L) quick opening cap for working pressure of 175 psig (1210 kPa).

## 2.3 TEST EQUIPMENT

### A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titrating burettes and associated reagents.

### B. Provide the following test kits:

1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 microhms.
7. Creosol red pH slide complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

- B. Place terminal control valves in open position during cleaning.
- C. Verify that electric power is available and of the correct characteristics.

### 3.2 CLEANING SEQUENCE

#### A. Concentration:

1. As recommended by manufacturer.
2. One pound per 100 gallons (1 kg per 1000 L) of water contained in the system.
3. One pound per 100 gallons (1 kg per 1000 L) of water for hot systems and one pound per 50 gallons (1 kg per 500 L) of water for cold systems.

#### B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F (71 degrees C) and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F (37.8 degrees C) or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

#### C. Chilled Water Systems:

1. Circulate for 48 hours, then drain systems as quickly as possible.
2. Refill with clean water, circulate for 24 hours, then drain.
3. Refill with clean water and repeat until system cleaner is removed.

#### D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

#### E. Remove, clean, and replace strainer screens.

- F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.4 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.
- C. Provide 3/4 inch (19 mm) water coupon rack around circulating pumps with space for 4 test specimens.

END OF SECTION





SECTION 15556  
CAST IRON BOILERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Boilers.
- B. Controls and boiler trim.
- C. Hot water connections.
- D. Fuel connection.
- E. Collector, draft hood, and chimney connection.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Section 15515 - Hydronic Specialties.
- C. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- D. Installation of indoor/outdoor reset controller.
- E. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND REFERENCES  
(Latest Edition or Revision)

- A. AGA - Directory of Certified Appliances and Accessories.
- B. AGA Z21.13 - Gas-Fired Low-Pressure Steam and Hot Water Boilers.
- C. ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.
- D. ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
- E. HI (Hydronics Institute) - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.

- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - G. NFPA 31 - Installation of Oil Burning Equipment.
  - H. NFPA 54 (AGA Z223.1) - National Fuel Gas Code.
  - I. NFPA 70 - National Electrical Code.
  - J. UL 726 - Oil-Fired Boiler Assemblies.
  - K. UL - Gas and Oil Equipment Directory.
- 1.4 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Product Data: Provide data indicating general layout, rated capacities, weights (shipping, installed, and operating), dimensions, and size and location of water, gas, and vent connections, and electrical characteristics and connection requirements.
  - B. Shop Drawing: Submit shop drawings detailing fabrication and installation of equipment assemblies. Indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
  - C. Installation Instructions: Submit manufacturer's installation instructions.
  - D. Factory Test Reports: Submit reports, indicating and interpreting test results relative to compliance with specified requirements, for information.
  - E. Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.
  - F. Project Closeout: Refer to Divisions 0 and 1.
  - G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

- H. Submit wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer - installed wiring and field-installed wiring.

#### 1.5 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm whose boilers are listed by product name and manufacturer in The Hydronics Institute's "I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation" and comply with requirements indicated.
- B. Comply with NFPA 70 "National Electrical code" for components and installation.
- C. Listing and Labeling:
  - 1. Provide products specified in this Section that are listed and labeled.
  - 2. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code, "Article 100.
  - 3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. ASHRAE Compliance: Minimum Steady State efficiency of boilers as prescribed by ASHRAE 90.1 "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings."
- E. ASME Compliance: Fabricate and stamp boilers according to ASME Boiler and Pressure Vessel Code, Section IV, "Heating Boilers."
- F. I=B=R Compliance: Boilers tested and rated according to The Hydronics Institute's "Testing and Rating Standard for Heating Boilers," with I=B=R emblem on a nameplate affixed to the boiler.
- G. FM Compliance: Control devices and control sequences according to requirements of Factory Mutual System (FM).

- H. IRI Compliance: Control devices and control sequences according to requirements of Industrial Risk Insurers (IRI).
- I. Coordination: Coordinate layout and installation of boilers with related work.
  - 1. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer.
  - 2. Coordinate size and location of concrete housekeeping pads.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70 for internal wiring of factory wired equipment.
- B. Conform to ASME SEC 4 and SEC 8D, AGA Z21.13 and UL 726 for boiler construction.
- C. Units: AGA certified, UL labeled.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Transport, handle, store, and protect products under provisions of Divisions 0 and 1.
- B. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.
- C. Deliver boilers in sufficient time to allow movement into building.

#### 1.9 WARRANTY

- A. Provide a ten year pro-rated warranty for cast iron boiler sections.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURED UNITS

- A. Acceptable Manufacturers:
  - 1. Burnham Corp.

2. Cleaver Brooks Corp.
  3. Peerless Heater Co.
  4. Weil-McLain.
  5. Approved equal under provisions of Divisions 0 and 1.
- B. Hot Water Boilers: Suitable for forced draft with insulated jacket, sectional cast iron heat exchanger, gas burning system, refractory, relief valve, gauges, controls, fuel train, and boiler trim.
- C. Electrical Characteristics:
1. Refer to Section 16180.

## 2.2 FABRICATION

- A. Assembly: Cast iron sections with 80 psig (550 kPa) water ASME Boilers and Pressure Vessels Code rating, assembled with push nipples or gaskets and draw rods.
- B. Access: To flue passages for cleaning and flame observation ports.
- C. Structural Base: Aluminized steel lined with high temperature mineral fiber insulating panels.
- D. Jacket: Glass fiber insulated steel jacket, finished with factory applied baked enamel.

## 2.3 HOT WATER BOILER TRIM

- A. ASME rated pressure relief valve, 80 psig (550 kPa).
- B. Combination water pressure and temperature gage.
- C. Low water cut-off to prevent burner operation when boiler water falls below safe level.
- D. Electronic operating temperature controller:
1. NEMA 250 Type 1 enclosure with full cover for wall mounting.
  2. Ambient temperature range - 30 to 150 degrees F (-34 to 66 degrees C).

3. Adjustable reset ratio of outside air temperature change to discharge control point change 1:2 to 100:1.
  4. Integral set point adjustment 80 to 230 degrees F (27 to 110 degrees C).
  5. Electronic primary and outdoor sensors.
  6. Suitable for on-off switching of pilot duty single throw double pole relays.
- E. High limit temperature controller with manual reset for burner to prevent boiler water temperature from exceeding safe system temperature.
- F. Boiler air vent.

#### 2.4 FUEL BURNING SYSTEM

- A. Burner Operation: modulating with low fire position for ignition.
- B. Gas Burner: Forced draft type for natural gas adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off.
- C. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, [energize blower motor, and after air flow proven] [and] slight delay, allow gas valve to open.
- D. Collector and Draft Hood: Aluminized steel flue collector hood.
- E. Controls: Pre-wired, factory assembled electronic controls in control cabinet with flame scanner or detector, programming control, relays, and switches. Provide pre-purge and post-purge ignition and shut-down of burner in event of ignition pilot and main flame failure with manual reset.

#### 2.5 PERFORMANCE

- A. Performance rating shall be in accordance with HI - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine area to receive boiler for compliance with installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install boilers level and plumb, according to manufacturer's written instructions, rough-in drawings, and referenced standards.
- C. Install in accordance with NFPA 54 and NFPA 31.
- D. Install boiler on a 4 inch (102 mm) thick concrete housekeeping pad, sized minimum 6 inches (152 mm) larger than boiler base. Cast anchor-bolt inserts into pads. Refer to Section 03300.
- E. Provide connection of natural gas service in accordance with NFPA 54 (AGA Z223.1), and NFPA 31.
- F. Provide piping connections and accessories as indicated; refer to Section 15515.
- G. Pipe relief valves to nearest floor drain.
- H. Provide for connection to electrical service. Refer to Section 16180.
- I. Install electrical devices furnished with boiler but not specified to be factory mounted.

### 3.3 CONNECTIONS

- A. Provide services of a factory-authorized service representative to supervise the piping and electrical connections.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Connect hot water piping to supply and return boiler tapings, according to requirements of Division 15 Section

"Hydronic Piping." Provide shutoff valve and union or flange at each connection.

- D. Connect breeching to boiler outlet, full size of outlet, according to requirements of Division 15 Section "Breechings, Chimneys, and Stacks."
- E. Connect gas piping to boiler to full size of boiler gas train inlet, according to requirements of Division 15 Section "Natural Gas Piping Systems." Provide union with sufficient clearance for burner removal and service.

### 3.4 FIELD QUALITY CONTROL

- A. Hydrostatically test assembled boiler and piping, according to applicable sections of ASME Boiler and Pressure Vessel Code.

### 3.5 ADJUSTING AND CLEANING

- A. Flush and clean boilers upon completion of installation, according to manufacturer's instructions.
- B. Clean factory-finished surfaces, and repair any marred or scratched surfaces with manufacturer's touchup paint.

### 3.6 COMMISSIONING

- A. Provide services of a factory-authorized service representative to provide startup service.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements of Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment installer.
- C. Start boilers according to manufacturer's instructions.
- D. Adjust burner for maximum burning efficiency.
- E. Operate and adjust controls and safeties.

### 3.7 DEMONSTRATION

- A. Provide services of a factory-authorized service representative to demonstrate boiler and train Owner's maintenance personnel.



- B. Operate boiler, including accessories and controls, to demonstrate compliance with requirements.
- C. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- D. Review data in the operation and maintenance manuals. Refer to Section 15010 and Divisions 0 and 1 for Operating and Maintenance Data.
- E. Schedule training with Owner with at least 7 days' advance notice.

### 3.8 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Divisions 0 and 1.
- B. Instruct operating personnel in operation and maintenance of units.

END OF SECTION



SECTION 15682

AIR COOLED WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chiller package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Chilled water connections.
- E. Starters.
- F. Electrical power connections.

1.2 RELATED SECTIONS

- A. Section 15170 - Motors
- B. Section 15245 - Vibration Isolation.
- C. Section 15510 - Hydronic Piping.
- D. Section 15540 - HVAC Pumps.
- E. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- F. Section 15990 - Testing, Adjusting, and Balancing.
- G. Section 16180 - Equipment Wiring Systems.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ANSI/ARI 590 - Reciprocating Water - Chilling Packages.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code

- E. ANSI/NEMA MG 1 - Motors and Generators.
  - F. ANSI/UL 465 - Central Cooling Air Conditioners.
  - G. NFPA 70 - National Electrical Code.
- 1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Shop Drawings: Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and thermostatic valves required for complete system.
  - B. Product Data: Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.
  - C. Certification: Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturers requirements.
  - D. Installation Instructions: Submit manufacturer's installation instructions.
  - E. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble- shooting guide.
- 1.5 REGULATORY REQUIREMENTS
- A. Conform to ANSI/ARI 590 code for testing and rating of reciprocating water chillers.
  - B. Conform to ANSI/UL 465 code for construction of reciprocating water chillers.
  - C. Conform to ANSI/ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of reciprocating water chillers.
  - D. Conform to ANSI/ASHRAE 15 code for construction and operation of reciprocating water chillers.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products under provisions of Divisions 0 and 1.
- B. Protect units before, during and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.7 WARRANTY

- A. Provide one year warranty from date of equipment start up covering defects in material and workmanship.
- B. Provide extended five year warranty for compressors.

1.8 MAINTENANCE SERVICE

- A. Furnish service and maintenance of complete assembly for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Carrier Corp.
- B. Dunham-Bush, Inc.
- C. Snyder General Corp.
- D. Trane Company.
- E. York International Corp.
- F. Approved equal under provisions of Divisions 0 and 1.

2.2 MANUFACTURED UNITS

- A. Provide factory assembled and tested outdoor air cooled liquid chillers consisting of reciprocating compressors, condenser, evaporator, thermal expansion valve, refrigeration accessories, and control panel.  
Construction and ratings shall be in accordance with ANSI/ARI 590.

2.3 COMPRESSORS

- A. Construct semi-hermetic or hermetic reciprocating compressors with heat treated forged steel or ductile iron

shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, suction and discharge valves, and sealing surface immersed in oil.

- B. Statically and dynamically balance rotating parts and mount on rubber-in-shear vibration isolators.
- C. Provide reversible, positive displacement, oil pump lubrication system with oil charging valve, oil level sight glass, oil filter, and magnetic plug on strainer, arranged to ensure adequate lubrication during starting, stopping, and normal operation.
- D. Provide compressor with automatic capacity reduction equipment consisting of suction valve unloaders. Provide for unloaded compressor start.
- E. Provide constant speed compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for across-the-line starting. Refer to Section 15170. Furnish with starter.
- F. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating.

#### 2.4 EVAPORATOR

- A. Provide shell and tube type evaporator, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets.
- B. Design, test, and stamp refrigerant side for 225 psig (1550 kPa) working pressure and water side for 150 psig (1030 kPa) working pressure, in accordance with ANSI/ASME SEC 8.
- C. Insulate with 0.75 inch (19 mm) minimum thick flexible polyurethane foam insulation with maximum K value of 0.28 Btu\*in/Hr\*Sq Ft\*°F(0.040 watts/M\*°K). Provide heat tape to protect evaporator to -20 degrees F (-29 degrees C).
- D. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.

#### 2.5 CONDENSERS

- A. Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling

circuits with liquid accumulators. Air test under water to 425 psig (2930kPa).

- B. Provide vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Provide factory mounted, louvered, galvanized steel coil guard panels.
- C. Provide fan motors with permanently lubricated ball bearings and built-in current and overload protection. Refer to Section 15170.

## 2.6 ENCLOSURES

- A. House components in galvanized steel panels with weather resistant, baked enamel finish.
- B. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

## 2.7 HEAT RECOVERY CONDENSERS

- A. Provide condensers of shell and tube type, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets.
- B. Design, test, and stamp refrigerant side for 450 psig (3100 kPa) working pressure in accordance with ANSI/ASME SEC. 8
- C. Provide 450 psig (3100 kPa) safety relief valve on condenser shell.
- D. Design, test and stamp water side for 150 psig (1030 kPa) working pressure in accordance with ANSI/ASME SEC. 8.

## 2.8 REFRIGERANT CIRCUIT

- A. Provide refrigerant circuits, factory supplied and piped. Refer to Section 15535.
- B. Provide for each refrigerant circuit:
  - 1. Liquid line solenoid valve.
  - 2. Filter dryer (replaceable core type).
  - 3. Liquid line sight glass and moisture indicator.

4. Thermal expansion valve sized for maximum operating pressure.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Condenser pressure relief valve.

## 2.9 CONTROLS

- A. On chiller, mount weatherproof steel control panel, containing starters power and control wiring, factory wired with single point power connection.
- B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection.
- C. Provide the following safety controls arranged so that operating any one will shut down machine and require manual reset:
  1. Low chilled water temperature switch.
  2. High discharge pressure switch.
  3. Low suction pressure switch.
  4. Oil pressure switch.
  5. Flow switch in chilled water line.
  6. Relay for remote mounted emergency shut-down switch.
- D. Provide the following operating controls:
  1. Multi-step chilled water temperature controller which cycles compressors.
  2. Five minute off timer prevents compressor from short cycling.
  3. Periodic pump-out timer to pump down on chilled water flow and high evaporator refrigerant pressure.



4. Solenoid valve between heat recovery condenser and receiver to limit refrigerant level in condenser.
  5. Load limit thermostat to limit compressor loading on high return water temperature.
  6. Low ambient control consisting of external damper assembly, controls head pressure for operation down to 0 degrees F (-18 degrees C).
  7. Hot gas bypass sized for minimum compressor loading, bypasses hot refrigerant gas to evaporator.
- E. Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressures.
- F. For multiple units, provide remote mounted sequence panel to allow operation in series with lead-lag switching.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on steel or concrete foundations.
- C. Install units in vibration isolation. Refer to Section 15245.
- D. Connect to electrical service. Refer to Section 16180.
- E. Connect to chilled water piping. Refer to Section 15510. On inlet, provide thermometer well for temperature controller, flow switch, flexible pipe connector, and shut-off valve. On outlet, provide flexible pipe connector and balancing valve.
- F. Connect to heat recovery condenser water piping. Refer to Section 15510. On inlet, provide flexible pipe connector and shut-off valve. On outlet, provide flexible pipe connector and balancing valve.
- G. Arrange piping for easy dismantling to permit tube cleaning.

### 3.2 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Divisions 0 and 1.
- B. Supply service of factory trained representative to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.
- C. Supply initial charge of refrigerant and oil.

### 3.3 DEMONSTRATION

- A. Provide systems demonstration under provisions of Divisions 0 and 1.
- B. Demonstrate system operation and verify specified performance. Refer to Section 15990.

END OF SECTION

SECTION 15790

AIR COILS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water coils.

1.2 RELATED SECTIONS

- A. Section 15260 - Piping Insulation.
- B. Section 15515 - Hydronic Specialties.
- C. Section 15890 - Ductwork: Installation of duct coils.
- D. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- E. Section 16180 - Equipment Wiring Systems.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ANSI/ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
- B. NFPA 70 - National Electrical Code.
- C. ANSI/UL 1096 - Electric Central Air Heating Equipment.
- D. SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.4 SUBMITTAL: Government approval is required for submittal with a (GA)designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Shop Drawings: Submit shop drawings indicating coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- B. Product Data: Submit product data indicating coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

- C. Installation Instructions: Submit manufacturer's installation instructions under provisions of Section 15010.
- D. Certificate: Submit manufacturer's certificate under provisions of Section 15010 that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements, and that coils are tested and rated in accordance with ANSI/ARI 410.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Divisions 0 and 1.
- B. Store and protect products under provisions of Divisions 0 and 1.
- C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.
- D. Protect coils from entry of dirt and debris with pipe caps or plugs.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS - HYDRONIC COILS

- A. Carrier Corp.
- B. Dunham-Bush, Inc.
- C. Snyder General Corp.
- D. Trane Company.
- E. York International Corp.
- F. Approved equal under provisions of Divisions 0 and 1.

## 2.2 FABRICATION

- A. Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- B. Fins: Aluminum or copper continuous plate type with full fin collars or individual helical finned tube type wound under tension.
- C. Capacity: As scheduled.

## 2.3 WATER HEATING COILS

- A. Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.
- B. Testing: Air proof test under water to minimum 300 psig (2068 kPa) and leak test for working pressure of 200 psig (1380 kPa) and 220 degrees F (104 degrees C).
- C. Configuration: Drainable, with threaded plugs [in headers] for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.
- D. Fin Spacing: 8 fins per inch (3.1 mm on center).

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- C. Support coil sections independent of piping on steel channel or double angle frames and secure to casings. Provide frames for maximum three coil sections. Arrange supports to avoid piercing drain pans. Provide airtight seal between coil and duct or casing.
- D. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- E. Install coils level. Install cleanable tube coils with 1:50 pitch.
- F. Make connections to coils with unions and flanges.

- G. On water coils, provide shut-off valve on supply line and lockshield balancing valve on return line. Locate water supply at bottom of supply header and return water connection at top. Provide manual air vents at high points complete with stopvalve. Ensure water coils are drainable and provide drain connection at low points.
- H. On water heating coils, connect water supply to leaving air side of coil (counterflow arrangement).
- I. On refrigerant coils, provide sight glass in liquid line within 12 inches (305 mm) of coil.
- J. Insulate headers located outside air flow as specified for piping. Refer to Section 15260.

END OF SECTION

SECTION 15835

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Unit heaters.
- B. Electric unit heaters.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Installation of unit ventilator wall louvers.
- B. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems: Installation of room thermostats.
- C. Section 16180 - Equipment Wiring Systems: Installation of room thermostats.

1.3 RELATED SECTIONS

- A. Section 15170 - Motors.
- B. Section 15510 - Hydronic Piping.
- C. Section 15515 - Hydronic Specialties.
- D. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- E. Section 16180 - Equipment Wiring Systems: Electrical supply to units.

1.4 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. NFPA 70 - National Electrical Code.
- B. ARI 440 - Room Fan Coil Air Conditioners.
- C. UL 883 - Safety Standards for Fan Coil Units and Room Fan Heater Units.
- D. Hydronics Institute HYI-01-I=B=R Ratings for Baseboard Radiation and Finned Tube (Commercial) Radiation.

1.5 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an OFI00 designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Shop Drawings: Submit shop drawings indicating cross section of cabinets, grille, bracing and reinforcing, and typical elevation.
- B. Product Data: Submit product data indicating typical catalog of information including arrangements.
- C. Schedules: Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
- D. Service Location: Indicate mechanical and electrical service locations and requirements, specifically indicating deviations from indicated products.
- E. Installation Instructions: Submit manufacturer's installation instructions under provisions of Section 15010.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 15010.
- B. Accurately record actual locations of access doors in radiation cabinets required for access or valving.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 15010.
- B. Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.



1.9 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70 code for internal wiring of factory wired equipment.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Divisions 0 and 1.
- B. Store and protect products under provisions of Divisions 0 and 1.
- C. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.11 SEQUENCING AND SCHEDULING

- A. Sequence work under the provisions of Divisions 0 and 1.
- B. Schedule work under the provisions of Divisions 0 and 1.
- C. Install unit heaters (equipment exposed to finished areas) after walls and ceiling are finished and painted. Avoid damage.

1.12 WARRANTY

- A. Provide one year manufacturer's warranty on units and component assemblies from date of equipment start up under provisions of Divisions 0 and 1.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - UNIT HEATERS

- A. Carrier Corp.
- B. International Environmental Corp.
- C. Modine Mfg Co.
- D. Sterling.
- E. Trane Company.
- F. Approved equal under provisions of Divisions 0 and 1.

## 2.2 UNIT HEATERS

- A. Coils: Seamless copper tubing, 0.025 inch (0.64 mm) minimum wall thickness, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.
- B. Casing: 18 gage (1.3 mm) steel with threaded pipe connections for hanger rods.
- C. Finish: Factory apply baked enamel finish on visible surfaces of enclosure or cabinet.
- D. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- E. Air Outlet: Adjustable air discharge louvers on horizontal unit heaters. Vertical unit heaters shall have cone diffusers
- F. Motor: Refer to Section 15170; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- G. Control: Thermostat range shall be 45 deg.F to 90 deg.F. Provide thermal overload protection. Remote Thermostat shall be as scheduled on drawings.
- H. Capacity: Based on 65 degree F (18 degree C) entering air temperature, 180 degree F (82 degree C) average entering water temperature.

## 2.3 ACCEPTABLE MANUFACTURERS - ELECTRIC UNIT HEATERS

- A. Berko Company.
- B. Markel Products Co.
- C. Trane Company.
- D. Approved equal under provisions of Divisions 0 and 1.

## 2.4 ELECTRIC UNIT HEATERS

- A. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.

- B. Heating Elements: Elements shall be high mass, all steel tubular finned type, copper brazed. Centrally located and installed in fixed element banks.
- C. Cabinet: 18 gage (1.3 mm) steel with easily removed front panel with integral air outlet and inlet grilles.
- D. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.
- F. Motor: Refer to Section 15170; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- G. Control: Unit mounted, factory wired, summer fan switch and thermostat. Thermostat range shall be 45 deg.F to 90 deg.F. Provide thermal overload protection. Unit mounted thermostat shall be as scheduled on drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work and opening dimensions are as indicated on shop drawings and instructed by the manufacturer.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing surfaces.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Hang unit heaters from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- C. Protect units with protective covers during balance of construction.

- D. Provide hydronic units with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For unit heaters, provide float operated automatic air vents with stop valve.

### 3.3 CLEANING

- A. Clean work under provisions of Section 15010.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- D. Install new filters.

END OF SECTION

SECTION 15850

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Variable frequency drives.

1.2 RELATED SECTIONS

- A. DIVISIONS 0 and 1 - CONTRACT REQUIREMENTS and GENERAL REQUIREMENTS: These shall apply to all work included in this section.
- B. Related Work:
  - 1. Section 15010 - BASIC MECHANICAL REQUIREMENTS.
  - 2. Section 15170 - MOTORS.
  - 3. Section 15540 - HVAC PUMPS
  - 4. Section 15950 - HEATING, VENTILATING AND AIR CONDITIONING HVAC CONTROL SYSTEMS.
  - 5. Section 15980 - INSTRUMENTATION.
  - 6. Section 15990 - TESTING, ADJUSTING AND BALANCING.
  - 7. Division 16000 -ELECTRICAL (All Applicable Sections).

1.3 SCOPE OF WORK

- A. The Contractor shall provide all materials, labor, tools, and equipment required for the proper installation of variable frequency drives as indicated on the plans, as specified herein, and as required for a complete and operational system.
- B. Everything necessary for a complete and satisfactory installation, including all parts, devices, accessories, etc., required by applicable codes or that may be required to satisfactorily complete the installation of the variable frequency drives shall be provided by the Contractor.

- C. All options as required in these specifications shall be provided.
  - D. All drives as indicated shall be from a single manufacturer.
- 1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Data Submittal shall show, as a minimum, the data as listed below. Equipment rejected in first submittal will be required to be furnished as specified. Substitutions will not be considered after original submittal has been reviewed.
    - 1. Name of manufacturer.
    - 2. Type of drive (type of inverter).
    - 3. Location and use.
    - 4. Enclosure type and exterior dimensions.
    - 5. Capacity of equipment.
    - 6. Circuit diagram.
    - 7. Certified performance test data for each drive type (e.g., PWM, VVI or CSI) and for each drive size shall include:
      - a. Graph of drive efficiency versus load.
      - b. Graph of input power factor versus load.
    - 8. Certified performance tests of the following shall include frequencies generated, their relative strengths, oscilloscope curve traces (if applicable) at twenty-five, fifty, seventy-five, and one hundred percent rated load. These tests shall be performed in relation to the performance of the motor operating across the line with the VFD in bypass mode for the largest drive of each type (e.g., PWM, VVI and CSI).
      - a. Air-borne sound in drive shall not be excessive in the application intended.

- b. Harmonic reflected back into the power supply system based on IEEE519-1981 in the 5th and 7th order harmonics shall be limited to 5 and 10% respectively.
      - c. Electromagnetic (EMI) and radio frequency (RFI) interference.
    - 9. Name, address, phone number of a factory-trained, 24 hour service agency.
  - B. Variable Frequency: Variable frequency drive submittals shall be bound, indexed, and tabbed. Loose and/or unorganized cut sheets will not be accepted. SUBMITTALS WHICH ARE NOT IN THE FORMAT AS INTENDED BY THIS SPECIFICATION WILL BE RETURNED UNCHECKED.
    - 1. If the submitted drive package differs in any respect from the requirements listed in this specification, then such differences shall be directly addressed. Each difference (whether it exceeds or lacks the listed requirement) shall be listed in the submittal, and cross-referenced to the appropriate paragraph in this specification. Documentation shall also be included which supports the proposed drive package's status with regard to each of the differences encountered. Compensating options and features not specified shall also be included.
- 1.5 CODES AND STANDARDS (Latest edition or revision)
- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
  - B. National Electrical Manufacturer's Association (NEMA) Publications:
    - 1. ICS1-1978 - General Standards for Industrial Control and Systems.
    - 2. ICS2-1978 - Standards for Industrial Control Devices Controllers and Assemblies
    - 3. ICS4-1977 - Terminal Blocks for Industrial Control Equipment and Systems
    - 4. ICS6-1978 - Enclosures for Industrial Controls and Systems

C. National Fire Protection Association (NFPA) Publication:

1. 70 (Latest Revision) - National Electrical Code (NEC).

D. Federal Communication Commission Rules, Part 15, Subpart J, Class A Equipment.

E. Institute of Electronic and Electrical Engineers (IEEE) Standard 519 - 1981.

1.6 OPERATION AND MAINTENANCE MANUALS

A. As specified in Section 15010, the Contractor shall provide the Owner with bound copies of operations and maintenance data covering the drive and rating. Manuals shall be indexed and tabbed thereby organizing data. Basic troubleshooting criteria for drive and rating shall also be included. The Contractor shall provide in these manuals the name and telephone number(s) of a factory trained and qualified service organization within a 50 mile radius of a facility capable of servicing and repairing the VFD drive units. This service organization shall be available on a 24 hour per day basis, and shall keep in stock a ready supply of spare parts for drive rating and type.

1.7 WARRANTY

A. The VFD manufacturer shall provide a one year warranty from date of final acceptance covering all defects in materials and workmanship pertinent to the VFD unit. In addition the Contractor shall warrant to the Owner all work performed under this contract to be free from defects in workmanship and materials for a period of one year from date of final acceptance. Warranty shall also include all parts, labor, transportation and living expenses of factory personnel. Acceptance will not be given until all defects in all variable flow system components have been remedied, and each system successfully tested and run in its entirety. Defects arising during this period shall be promptly remedied by the Contractor at his own expense upon notice by the Owner.

1.8 INSPECTION OF SITE

A. Prior to submitting bid, the Contractor shall visit the site of the proposed construction and thoroughly acquaint himself with all existing facilities and working conditions to be encountered.



## 1.9 ACCURACY OF DATA

- A. The drawings indicate the work intended. Care has been exercised to prepare the drawings as accurately as possible: however, accuracy is not guaranteed. It shall be the sole responsibility of the Contractor to verify all dimensions, take his own field measurements, and install all work to suit conditions encountered on the job site.
- B. The drawings are generally diagrammatic and except where dimensions are indicated are not intended to show the exact locations of equipment. All work shall be installed as nearly as possible in the locations indicated, with minor adjustments as required to avoid interferences with structure or the work of other trades.
- C. The Contractor is cautioned to pay particular attention to the space limitations for all equipment and determine before bidding that all equipment which he proposes to use will fit properly into the space provided, with adequate clearance for service and adjustments.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. ASEA.
- B. York.
- C. Robicon Corp.
- D. Reliance Electric Co.
- E. MagneTek, ASD Division.
- F. Approved equal under provisions of Divisions 0 and 1.

### 2.2 BASIC EQUIPMENT DESCRIPTION

- A. This specification covers AC variable speed drives (adjustable frequency).
- B. The drive shall be suitable for operation on standard NEMA design B motors and NEMA design F motors. The drive will have a diode bridge rectifier on the input to minimize the generation of electrical noise back into the line and provide near unity power factor.

- C. The drive horsepower rating will range as scheduled, with a speed range of 3 to 60 Hz. The drive shall be capable of an overload of 120% for 60 seconds.
- D. Output devices shall be transistors. For larger horsepowers an output filter shall be available as an option to reduce motor noise due to PWM waveform. In both cases audible noise shall be reduced so that it is at or near the noise levels common when running the motor on utility power.
- E. The drive shall be UL or E.T.L. listed.
- F. The drive shall be housed in a NEMA type one enclosure with metal cabinets for R.F. Shielding.
- G. The drive shall be capable of operation under any combination of the following conditions without mechanical or electrical damage:

Ambient Temperature: 14 to 104 degrees F  
(-10 to 40 degrees C)

Relative Humidity: Less than 90% non-condensing

Altitude: Less than 3300 ft.(1,000m)  
above sea level

Vibration: Less than 0.5 G for 20-50 Hz  
Less than 0.1mm (peak to peak)  
for 50-100 Hz

Control System: Sinusoidal pulse width  
modulated voltage waveform

Output Voltage: 3 phase 380 to 460 Volt

Frequency Accuracy: +/- 0.5% of max. frequency

Setting Frequency Range: 3 to 60 Hz

Volts/Hertz Ratio: 3 to 60 Hz, V/Hz dependent on  
load (automatic) 60 Hz and up,  
Voltage constant

Operation Frequency Range: 0 to 60 Hz

- H. Overload Capacity: 120% for 60 seconds. A microprocessor shall monitor the load on the drive and in the event of an overload it shall, based on the calculation of a true

inverse time overload characteristic, either trip out or phase back the voltage and speed as selected by an internal jumper.

- I. Be able to operate under on site generated power as required.

## 2.3 DIGITAL READOUT AND MONITOR

- A. Seven (7) segment LED's will display off, low speed, frequency and fault. With front accessible pushbutton, user can monitor % current, % voltage, frequency, acceleration and deceleration time, input bias, input gain, upper and lower limit. Drive readout also provides drive status and protective circuits status.

## 2.4 PROTECTION

- A. The variable speed drive system shall include a diode bridge rectifier, capacitor filter, and transistorized inverter section. Base driver signals to control firing of the power transistors will be designed isolated for maximum protection of the control circuits from high voltage and noise. The output will be a sinusoidal waveform, pulse width modulated, voltage waveform for reduced harmonic heating in the motor.
- B. The system protection as a minimum will provide the following:
  1. Frequency Stall (110% causes acceleration stop, over 110% causes phase-back control).
  2. Current Limit (120%).
  3. Overcurrent - 180% IET.
  4. Short Circuit - phase to phase or phase to ground (trips fault).
  5. Overvoltage - High DC bus voltage (trips fault).  
460V Series      800VDC
  6. Undervoltage- 85% below line voltage(indicates fault).
  7. Component burnout - DC bus fuse protection and/or 3 phase input fusing.
- C. Digital Indication of Fault: When the drive trips out on a fault, the drive shall activate a fault relay with

normally open and normally closed contacts available to the user and an LED display shall indicate the reason for the trip as follows:

1. OC: Overcurrent trip at 120%
2. OCA: Internal component short circuit
3. OCL: Output short circuit
4. OL: Overload (when soft stall not selected)
5. OP: Overvoltage on DC bus
6. OPS: Overvoltage on input
7. UP: Undervoltage
8. OH: Overheat or Closing of terminals "OH"
9. EF: Ground Fault (Earth Fault)

D. Auto restart shall be a standard feature of the drive as follows:

1. Auto restart enable or disabled by jumper or programmable selection. Programmable drives shall be supplied with non-volatile RAM.
2. If auto restart is selected, the microprocessor shall determine, in the event of a fault, if a restart should be attempted. A restart will be attempted under the following conditions:
  - a. Undervoltage (UP) - every time as soon as voltage returns to a safe level. Fault relay is not activated (not jumper selectable).
  - b. Input Overvoltage (OPS) and DC Bus Overvoltage (OP) - every time if voltage returns to normal within 30 seconds, fault relay is not activated and reset for 30 seconds (jumper selectable).
  - c. Overcurrent (OC) - drive delays 1 second and attempts a restart. If drive trips a second time, it delays 2 seconds and attempts a second restart. Overall, five attempts are made after successive delays of 1, 2, 4, 8, and 16 seconds. If the restart fails after the fifth attempt, the drive

will trip out and activate the fault relay (jumper selectable).

3. A restart will not be attempted for any other type of fault and the drive will trip out immediately, activate the fault relay and make the appropriate indication on the display.
- E. In the event of a fault trip, the microprocessor shall save the status of the drive at the time of the fault and make that information available on the LED display until the drive is reset or the control power is removed.
- F. An undervoltage condition of less than 30ms duration shall not affect drive operation. If main power falls below 85% of rated voltage for longer than 30ms while control power is retained, the drive shall forcibly decelerate the load in an attempt to force a higher bus voltage through regeneration. This feature, depending on the inertia of the load, shall allow the drive to "ride through" a longer condition.
- G. Input Equipment: The VFD supplier shall supply the following with each drive:
  1. Incoming motor circuit protector and thermal overload.
  2. Mechanical transfer switch: For bypass of the inverter and transfer to line power. Transfer shall be via electrically operated contactor.
  3. A.C. Line Reactor: For reduction of harmonic content, power factor improvement and line transient suppression to 2-1/2%.
- H. Operational Functions:
  1. Acceleration and deceleration time independently adjustable from 1 to 20/6 to 120 seconds (selectable ranges).
  2. Signal follower 0-5VDC, 0-16VDC, 4-20ma, 0-20ma, selectable by jumper. An increasing input signal can command increasing or decreasing frequency as required by the application.
  3. Ramp to stop or coast to stop for normal operation (coast to stop on fault).

4. Volts/Hertz patterns selectable by rotary switch or programmable capability.
5. Upper and lower frequency limit adjustments shall be available. When the drive reaches one of the limits, it shall activate an open collector signal available to the user. A dry contact signal shall be available as an option.

## 2.5 REQUIRED OPTIONS

- A. Enclosure: All VFD components shall be factory mounted and wired in a grounded, wall mounted or free standing (as size of drive permits), NEMA 1 enclosure. The only additional wiring which will be required shall be to external alarm and controls, to the motor, and to the power source (motor control center, panelboard, etc.) as indicated on the plans or as specified.
- B. Terminal Blocks: All external wiring connections for power, signal, and alarm shall be facilitated by means of appropriately sized and rated terminal blocks located within the VFD enclosure. Fastening and electrical connection shall be made by a torqued, threaded lug or space type connector. Terminal blocks shall be insulated from the drive cabinet and other components and shall be CU/AL (copper/aluminum) rated.
- C. Bypass: Constant speed bypass shall be provided as indicated on the drawings to allow the motor to run across the line in the event of a drive shutdown. The transfer from the drive to the line shall be manually initiated and electrically operated. The bypass controls shall include a lockout circuit to enable transfer from drive to bypass (and vice versa) only during motor standstill. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power ON light, motor "ON VFD" light, and motor "ON LINE" light. All bypass components and line reactors shall be mounted and factory wired with the VFD in a common enclosure for all drives 50 horsepower and below. Dual cabinets for larger drives are acceptable where space limitations are encountered. However all such cases shall be submitted to the engineer for approval with the submittal documents. Electrical control voltage shall be wired through a separate circuit for the bypass such that all power can be shut down to VFD circuit for maintenance.
- D. Control Signal: Coordinate requirements with other applicable sections of these specifications. Also, a

single dry contact closure from the facilities management system shall be capable of system shutdown or startup when in the variable flow or the bypass mode of operation. Shutdown in the variable flow mode shall be performed electronically and shall not interrupt input power to the VFD.

- E. Depending upon the position of the manual/off/auto selector switch, the VFD shall operate as follows:
  - 1. Selector switch in the OFF position: The VFD run circuit shall be open and the variable frequency drive shall not operate. Operation of the existing driven load via bypass mode shall be possible with the VFD in this stage.
  - 2. Selector switch in the Manual position: The speed of the motor(s) shall be controlled by the manual speed potentiometer or electronic setting. All drive protective circuits shall be enabled, and alarm outputs shall be able to respond to actuation by drive protective circuitry. Manual transfer to constant speed operation shall also be possible.
  - 3. Selector switch in the Auto position: Operating speed shall be determined by the input signal with motor speed being linearly proportional between minimum and maximum speeds selected. All drive protective circuits shall be enabled, and alarm outputs shall be able to respond to actuation by drive protective circuitry. Manual transfer to constant speed operation shall also be possible.
- F. Depending upon the position of the VFD/Bypass switch, the unit shall operate as follows:
  - 1. Selector Switch in VFD Position: The manual/off/auto selector switch shall be enabled as indicated above and unit shall operate in normal VFD control.
  - 2. Selector Switch in Bypass Position: The bypass for the VFD will be initiated and motor startup/shutdown will be allowed when the control signal initiates system start/or stop.
- G. Provide single phase protection monitoring incoming power to protect in either bypass or VFD mode.

## 2.6 STARTUP AND SERVICE

- A. Adjustable frequency controller shall be started by factory trained service personnel. Startup service shall include instruction of owner's personnel in proper operation.

## PART 3 EXECUTION

### 3.1 DELIVERY AND STORAGE

- A. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before, during and after installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's recommendations and as approved by the Owner. Any damage to existing construction or to new equipment or materials which occurs as a result of improper action or inaction by the Contractor shall be remedied to the satisfaction of the Owner at no additional cost to the Owner.

### 3.2 INSTALLATION

- A. Location: VFD shall be located approximately where shown on plans. However, minor adjustments shall be made as required to avoid installation of the drive cabinet where the drive may be subject to extremes of heat or moisture. Care shall be exercised to avoid location of the drive close to (or under) steam or water lines of any type, heaters or any other types of heat producing equipment. The drives shall also not be located close to any existing equipment which may be sensitive to radio frequency or electromagnetic emissions produced by the drive. The drives shall not be located close to equipment which produces excessive vibration such as compressors of any type; drives especially shall not be installed on any mechanical equipment of any type.
- B. Installations: Installation shall only be to building structure such as floors, columns, or concrete or steel structure per manufacturer's recommendations. Where installation of drive cabinets is to be on partitions of light construction (such as gypboard and studs) additional strut type bracing shall be provided. Cabinet anchoring devices shall be as approved by the Engineer. Nails will not be allowed. Where installation of drive is on floor, provide a 6" high housekeeping pad extending 6" (152 mm) beyond the limits of the cabinet for the front and both sides.



- C. Connections: Electrical power and electrical control signal connections shall be made to the VFD drive via flexible metal conduit sized per the NEC. Connectors for flexible metal conduit shall have an integral grounding lug for use with an external grounding jumper wire.
- D. Workmanship: All work shall be performed by skilled workmen under the supervision and guidance of a competent superintendent and shall present a neat and workmanlike appearance when complete.
- E. Cleanup: Areas involved in the installation of the VFD shall be kept reasonably clean and free of excessive amounts of rubbish or waste materials caused by work under this contract. At the completion of work under this contract, all remaining rubbish and waste material shall be removed and the work site shall be left in clean condition.

### 3.3 SERVICE AND STARTUP

- A. Startup: The VFD manufacturer shall provide the services of factory trained service personnel to check out drive installation and external connections to the drive. Factory trained service personnel shall conduct thorough tests of the drive to assure proper operation of the drive under normal conditions. All such defects which are discovered as a result of these tests shall be remedied and the drive retested until no additional defects are discovered. Startup services and tests shall be conducted in the presence of an Owner's representative; and a tag shall be placed in the VFD drive noting the date of successful startup tests and the initials of personnel conducting and witnessing startup tests. This date shall be the "date of final acceptance" as specified for the warranty period to begin. The controls and all peripheral equipment shall be fully functional before final acceptance is provided.
- B. Training: The VFD manufacturer shall provide the training of Owner's personnel in basic troubleshooting of VFD drive. Training shall be on site and shall be a minimum duration of five (5) days in addition to system startup. Training shall occur only after successful startup of VFD system.
- C. Training shall be coordinated with owner's representative who shall provide a written list of personnel to attend the training session. This training shall be performed

using the prepared operation and maintenance manuals as specified as source materials.

3.4 TRAINING OF OWNER'S PERSONNEL AT VFD FACTORY

- A. The VFD manufacturer shall provide classroom/factory training at the VFD factory for two (2) persons (as selected by the Owner), for three (3) 8-hour days. All expenses, including travel, lodging, and food shall be paid by the VFD manufacturer. The Owner shall incur no expenses for this factory training in VFD operation, trouble-shooting, and maintenance. Two sets of free manuals/literature shall also be provided to the Owner, in addition to other requirements in these specifications.

END OF SECTION

SECTION 15855

AIR HANDLING UNITS WITH COILS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Packaged air handling units.
- B. Heating coils.
- C. Combination filter/mixing boxes.

1.2 RELATED SECTIONS

- A. Section 15121 - Expansion Compensation.
- B. Section 15170 - Motors.
- C. Section 15245 - Vibration Isolation.
- D. Section 15290 - Ductwork Insulation.
- E. Section 15790 - Air Coils.
- F. Section 15885 - Air Cleaning Devices.
- G. Section 15890 - Ductwork.
- H. Section 15910 - Ductwork Accessories: Flexible Duct Connections.
- I. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.

1.3 CODES AND STANDARDS  
(Latest edition or revision).

- A. AMCA 99 - Standards Handbook.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

- E. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Roller Bearings.
- G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- H. UL 181 - Factory-made Air Ducts and Connectors.
- I. UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.
- J. ANSI/UL 900 - Test Performance of Air Filter Units.
- K. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
- L. ARI 430 - Standard for Central-Station Air-Handling Units.
- M. ARI 435 - Standard for Application of Central-Station Air-Handling Units.
- N. NFPA 70 - National Electrical Code
- O. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- P. SMACNA - HVAC Duct Construction Standards - Metals and Flexible.
- Q. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- R. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans.
- S. FS F-F-300 - Filter, Air Conditioning: Viscous Impingement and Dry types; Cleanable.
- T. FS F-F-310 - Filter, Air Conditioning: Viscous Impingement and Dry Media, Replaceable.
- U. FS F-F-320 - Filters, Electronic Air Cleaning, Ionizing Plate Type.
- V. FS L-S-125 - Screening, Insect, Nonmetallic.
- W. FS RR-W-360 - Wire Fabric, Industrial.

- X. FS RR-W-365 - Wire Fabric (Insect Screening).
- Y. IEEE 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.
- Z. NEMA MG1 - Motors and Generators.
- AA. NEMA MG 10 - Energy Management Guide for Selection and Use of Polyphase Motors.
- BB. CIDA-A-1419 - Filter Element, Air-Conditioning, (Viscous - Impingement and Dry Types, Replaceable).

#### 1.4 QUALITY ASSURANCE

- A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
- C. Fabrication: Conform to AMCA 99 and ARI 430.
- D. Filter Media: ANSI/UL 900 listed, Class I or Class II, approved by authorities having jurisdiction.
- E. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- F. Air Handling Units: Products of manufacturer regularly engaged in production of components who issues complete catalog data on total product.
- G. Humidifiers: Certify capacities and selection in accordance with ARI 610.

#### 1.5 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Provide data of filter media, filter performance data, filter assembly, and filter frames.
3. Provide fan curves with specified operating point clearly plotted.
4. Submit sound power level data for both fan outlet and casing radiation at rated capacity.
5. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Installation Instructions: Submit manufacturer's installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance manuals under provisions of Section 15010. Manuals shall list step-by-step procedures required for system startup, operation, shutdown, and routine maintenance at least 2 weeks prior to field training.
- B. The manuals shall include the manufacturer's name, model number, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.
- C. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement,
- D. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, who issues complete catalog data on total product.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products to site under provisions of Divisions 0 and 1.
- B. Accept products on site under provisions of Divisions 0 and 1 in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- C. Store in clean dry place and protect from construction traffic, weather, humidity and temperature variations, dirt and dust, or other contaminants. Handle carefully to avoid damage to components, enclosures, and finish.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

## 1.10 EXTRA MATERIALS

- A. Provide one set of disposable filters and fan belts under provisions of Divisions 0 and 1.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier Corp.
- B. Snyder General Corp.
- C. Trane Company.
- D. York International Corp.
- E. Approved equal under provisions of Divisions 0 and 1.

## 2.2 GENERAL DESCRIPTION

- A. Air Handling Units shall be single zone draw-thru type as indicated.
- B. Configuration: Fabricate with fan sections plus accessories, including:
  - 1. Economizer section.
  - 2. Combination filter/mixing box section.
  - 3. Access section.
  - 4. Heating coil section.
  - 5. Cooling coil section.
  - 6. Vibration isolators.
- C. Factory fabricate and test air handling units of sizes, capacities, and configuration as indicated and specified in accordance with AMCA 99 and ARI 430.
- D. Base performance on local site conditions.

## 2.3 CASING

- A. Construction: Construct of 18 gauge (1.3 mm) galvanized steel on channel base or drain pan. Fabricate channel base, and drain pans, or welded steel coated externally with zinc chromate, iron oxide, or phenolic resin paint. Inner casing of double-wall units shall be minimum 20 gauge (1.0 mm) galvanized steel.
- B. Insulation: Insulate casing sections with 2 inch (51 mm) thick, 1-1/2 lbs/cu. ft (24 kg/cu. m) density, neoprene coated, glass fiber insulation, "K" valve at 75 degrees F maximum 0.23 Btu\*in/Hr\*sq.ft.\*degrees F ("ksi" valve at 42 degrees C maximum 0.037 Watts/m\*Degree K), sandwiched between inner and outer wall of mill galvanized steel, with support members. Insulation shall conform to NFPA 90A.
- C. Access Doors: Provide casings with access doors as indicated. Access doors shall be insulated, fully gasketed, double wall type, of a minimum 18 gauge (1.3 mm) outer and 20 gauge (1.0 mm) inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Provide minimum 8" x 8" (203 mm x 203 mm) inspection window of 1/4 inch (6 mm) thick plexiglass.



- D. Drain Pans: Construct drain pans from double thickness 16 gauge (1.6 mm) galvanized steel with insulation between layers, with welded corners. Cross break and pitch to drain connection. Provide drain pans under cooling coil section.
- E. Strength: Provide structure to brace casings for suction pressure of 2.5 inches wg (620 Pa), with maximum deflection of 1 in 200.
- F. Lights: Provide lights in accessible sections with wire guards, factory wired to weatherproof switch and duplex outlet mounted on casing exterior. In sprayed coil humidifier sections, provide marine lights of sealed glass and wire design.

## 2.4 FANS

- A. Type: Provide fan section with double width, double inlet, centrifugal type fan as scheduled on Mechanical drawings. Refer to Section 15860.
- B. Bearings: Provide self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of fan casing with aluminum tube and grease fittings rigidly attached to casing on drive side of air handler.
- C. Mounting: Locate fan and motor internally on welded steel base coated with zinc chromate. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through hinged access doors. Provide built-in inertia base of welded steel with bottom sheet and reinforcing grid for concrete ballast. Mount base on vibration isolators. Refer to Section 15245.
- D. Fan Accessories: Refer to Section 15860.
- E. Flexible Connection: Separate fan and coil sections with flexible connection. Refer to Section 15910.

## 2.5 MOTOR AND DRIVES

- A. Motors: As indicated, in compliance with Section 15170.
- B. Bearings: Fan bearings shall be sealed against dust and dirt, and shall be precision, self-aligning, grease-lubricated, heavy duty pillow block, ball or roller type.

Bearing life shall be L50 rated at not less than 200,000 hours as defined by AFBMA 9 and AFBMA 11.

- C. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- D. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch sheaves for motors 20 hp (15 kW) and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp (15 kW) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
- E. Belt Guard: Fabricate to SMACNA Standards; 12 gage (2.8 mm) thick, 3/4 inch (19 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

## 2.6 COILS

- A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
- B. Air Coils: Provide coils indicated for hot water heating. Certify capacities, pressure drops, and selection procedures in accordance with ARI 410. Refer to Section 15790.

## 2.7 FILTERS

- A. Filter Box: Provide section with filter guides, access doors from both sides, for side loading.
- B. Provide section with angle arrangement with 2 inch (51 mm) deep disposable panel filters. Refer to section 15885.
- C. Filter Gauges: Provide 3-1/2 inch (89 mm) diameter diaphragm actuated dial in metal case, with static pressure tips. Refer to section 15885.

## 2.8 DAMPERS

- A. Mixing Boxes: Provide section with factory mounted outside and return air dampers of galvanized steel with vinyl bulb edging in galvanized frame, with galvanized steel axles in self-lubricating bearings, in parallel blade arrangement with damper blades positioned across short air opening dimension. Provide removable, full width rack for supporting freeze protection thermostat, with removable end panel to permit rack removal. Provide mixing box with integral angle filter rack for 2 inch (51 mm) deep, disposable, pleated media filters. Filter/mixing box shall have access doors for filter access. Refer to Section 15885.
- B. Damper Leakage: Maximum 2 percent at 4 inch wg (1000 Pa) differential pressure when sized for 2000 fpm (10 m/sec) face velocity.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Work shall be installed as shown and in accordance with manufacturer's instructions, diagrams and recommendations and in conformance with ARI 435. Frames and supports shall be provided for items requiring supports.
- B. Assemble high pressure units by bolting sections together. Isolate fan section with flexible duct connections.
- C. Install assembled unit on vibration isolators. Refer to Section 15245.
- D. Install each air handling unit on a 4 inch (102 mm) concrete housekeeping pad. Housekeeping pad shall extend 6 inches (152 mm) larger than the overall dimensions of the supported unit.
- E. Install each filter type in accordance with manufacturer's directions.
- F. Arrange installation of units to provide access space around air handling unit for service and maintenance.
- G. Access panels shall be provided of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

### 3.2 CONNECTIONS

- A. Arrange piping connections adjacent to units to allow unit servicing and maintenance.
- B. Extend condensate drain lines to nearest floor drain and as indicated on mechanical drawings.
- C. Install flexible duct connections to unit components and as indicated on mechanical drawings.

### 3.3 PERFORMANCE TESTS

- A. Fan operation shall be stable over the entire volume range of the system.

### 3.4 CLEANING AND ADJUSTING

- A. Temporary filters shall be provided for all air handling units that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned.
- B. Air handling units shall be maintained in this clean condition until final acceptance.
- C. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer.
- D. Belts shall be tightened to proper tension.
- E. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

END OF SECTION

SECTION 15870  
POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof exhausters.

1.2 RELATED SECTIONS

- A. Section 15170 - Motors.
- B. Section 15245 - Vibration Isolators.
- C. Section 15890 - Ductwork.
- D. Section 15910 - Duct Accessories: Backdraft dampers.
- E. Section 15950 - Heating, Ventilating and Air Conditioning HVAC Control Systems.
- F. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. AMCA 99 - Standards Handbook.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- F. NEMA MG1 - Motors and Generators.
- G. NFPA 70 - National Electrical Code.
- H. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial cooking Equipment.

I. UL 705 - Power Ventilators.

1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 15010.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 EXTRA MATERIALS

A. Furnish under provisions of Divisions 0 and 1.

B. Provide two sets of belts for each fan.

PART 2 PRODUCTS

2.1 ROOF EXHAUSTERS AND VENTILATORS

A. Acceptable Manufacturers:

1. Acme Engineering & Mfg Co.

2. Greenheck Fan Corp.

3. Loren Cook Co.

4. Trane Company.

5. Approved equal under provisions of Divisions 0 and 1.

B. Product Requirements:

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
  3. Fabrication: Conform to AMCA 99.
  4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- C. Fan Unit: V-belt or direct driven as indicated, with spun aluminum downblast or upblast housing as scheduled; resilient mounted motor; 1/2 inch (13 mm) mesh, 16 gage (2 mm) aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.
- D. Roof Curb: 8 inch (203 mm) high of aluminum with continuously welded seams, 1 inch (25 mm) insulation and curb bottom, and factory installed nailer strip.
- E. Electrical Characteristics and Components
1. Electrical Characteristics:
    - a) Refer to Section 16180.
  2. Motor: Refer to Section 15170. NEMA MG1.
  3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
  4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.
- F. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.
- G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.
- 2.2 CABINET AND CEILING EXHAUST FANS
- A. Acceptable Manufacturers:
1. Acme Engineering & Mfg Co.
  2. Greenheck Fan Corp.

3. Loren Cook Co.
4. Approved equal under provisions of Divisions 0 and 1.
- B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing, lined with 1/2 inch (13 mm) acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- C. Electrical Characteristics and Components
  1. Electrical Characteristics:
    - a) Refer to Section 16180.
  2. Motor: Refer to Section 15170. NEMA MG1.
  3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
  4. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- D. Grille: Molded white plastic or aluminum with baked white enamel finish.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with aluminum lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Install flexible connections specified in Section 15910 between fan inlet and ductwork. Ensure metal bands of



connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.
- H. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION



SECTION 15885

AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Disposable, extended area panel filters.
- B. Filter gages.

1.2 RELATED SECTIONS

- A. Construction Facilities and Temporary Controls: Filters for temporary heating and ventilating.
- B. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ARI 850 - Commercial and Industrial Air Filter Equipment.
- B. ASHRAE 52 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- C. NFPA 70 - National Electrical Code.
- D. UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.
- E. UL 867 - Electrostatic Air Cleaners.
- F. UL 900 - Test Performance of Air Filter Units.

1.4 PERFORMANCE TOLERANCES

- A. Conform to ARI 850 Section 7.4.
- B. Dust Spot Efficiency: Plus or minus [5] percent.

1.5 SUBMITTALS

- A. Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 15010.
- B. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS

- A. Furnish under provisions of Divisions 0 and 1.
- B. Provide one set of disposable panel filters.

PART 2 PRODUCTS

2.1 DISPOSABLE, EXTENDED AREA PANEL FILTERS

- A. Acceptable Manufacturers:
  - 1. American Air Filter  
(Snyder General Corp).
  - 2. Cam-Farr, Co.
  - 3. Eco-Air Products, Inc.
  - 4. Approved equal under provisions of Divisions 0 and 1.

- B. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid.
  - 1. Frame: Enclosing frame shall be constructed of a rigid, heavy-duty, high wet-strength beverage board, with diagonal support members bonded to the air entering and air exiting side of each pleat, to ensure pleat stability.
  - 2. Nominal size: 24 x 24 inches (610 x 610 mm)].
  - 3. Nominal thickness: 2 inches (50 mm)].
- C. Performance Rating, ASHRAE 52:

## 2.2 FILTER GAGES

- A. Acceptable Manufacturers:
  - 1. Dwyer Instruments Inc.
  - 2. Honeywell, Inc.
  - 3. Approved equal under provisions of Divisions 0 and 1.
- B. Direct Reading Dial: 3-1/2 inch (89 mm) diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0-3.0 inch WG (0-750 Pa), 2 percent of full scale accuracy.
- C. Accessories: Static pressure tips with integral compression fittings, 1/4 inch (6 mm) aluminum tubing, 2-way or 3-way vent valves.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install air cleaning devices in accordance with manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- E. Provide filter gages on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 15890

DUCTWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casing and plenums.
- D. Duct cleaning.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Owner furnished kitchen range hoods.

1.3 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete.
- B. Section 09900 - Painting: Weld priming, weather resistant, paint or coating.
- C. Section 15140 - Supports and Anchors: Sleeves.
- D. Section 15290 - Duct Insulation: External insulation and duct liner.
- E. Section 15910 - Ductwork Accessories.
- F. Section 15940 - Air Inlets and Outlets.
- G. Section 15990 - Testing, Adjusting and Balancing.

1.4 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ASTM A 36 - Structural Steel.
- B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

- D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- F. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- K. ASTM C 14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- L. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- M. ASTM C 920 - Elastomeric Joint Sealants.
- N. ASTM E 814 - Fire Tests of Through-Penetration Fire Stops
- O. AWS D1.1 - Structural Welding Code - Steel.
- P. AWS D9.1 - Welding of Sheet Metal.
- Q. FS TT-S-001657 - Sealing Compound, Single Component Butyl Rubber Based, Solvent Release Type.
- R. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.
- S. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- T. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- U. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
- V. SMACNA - HVAC Air Duct Leakage Test Manual.



W. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

X. UL 181 - Factory-Made Air Ducts and Connectors.

#### 1.5 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

#### 1.6 SUBMITTALS: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

A. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.

B. Product Data: Provide data for duct materials, duct liner, and duct connectors.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

#### 1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 15010.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.8 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

B. Maintain one copy of document on site.

## 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

## 1.10 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

## 1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.
- B. Insulated Flexible Ducts:
  - 1. Acceptable Manufacturers:
    - a) Flexmaster USA, Inc.
    - b) Hart & Cooley, Inc.
    - c) Thermaflex.
    - d) Approved equal under provisions of Division 0 and 1.
  - 2. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; vapor barrier film. Maximum continuous length for duct runouts shall be 4 feet.

3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
  4. Maximum Velocity: 4000 fpm (20.3 m/sec).
  5. Temperature Range: -20 degrees F to 210 degrees F (-28 degrees C to 99 degrees C).]
- C. Fasteners: Rivets, bolts, or sheet metal screws.
- D. Sealant:
1. Acceptable Manufacturers:
    - a) Approved under provisions of Divisions 0 and 1.
  2. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- E. Hanger Rod: ASTM A36; steel; threaded both ends, threaded one end, or continuously threaded.
- 2.2 DUCTWORK FABRICATION
- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
  - B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
  - C. Increase duct sizes gradually, not exceeding 15 degrees (0.26 rad) divergence wherever possible; maximum 30 degrees (0.52 rad) divergence upstream of equipment and 45 degrees (0.79 rad) convergence downstream.
  - D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch (102 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

- E. Provide standard 45 degree (0.79 rad) lateral wye takeoffs unless otherwise indicated where 90 degree (1.57 rad) conical tee connections may be used.

## 2.3 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- B. Transverse Duct Connection System:

- 1. Acceptable Manufacturers:

- a) Approved under provisions of Divisions 0 and 1.

- 2. SMACNA "E" rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

## 2.4 CASINGS

- A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

- B. Mount floor mounted casings on 4 inch (102 mm) high concrete curbs. At floor, rivet panels on 8 inch (203 mm) centers to angles. Where floors are acoustically insulated, provide liner of 18 gage (1.3 mm) galvanized expanded metal mesh supported at 12 inch (305 mm) centers, turned up 12 inches (305 mm) at sides with sheet metal shields.

- C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

- D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage (1.60 mm) back facing and 22 gage (0.85 mm) perforated front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (76 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber media, on inverted channels of 16 gage (1.6 mm).

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch (203 mm) and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect flexible ducts to metal ducts with draw bands.
- I. Set plenum doors 6 to 12 inches (152 to 305 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- J. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

### 3.2 CLEANING

- A. Clean work under provisions of Section 15010.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- C. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt

with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

### 3.3 SCHEDULES

#### A. DUCTWORK MATERIAL SCHEDULE

<u>AIR SYSTEM</u>	<u>MATERIAL</u>
Low Pressure Supply	Galvanized Steel
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel

#### B. DUCTWORK PRESSURE CLASS SCHEDULE

<u>AIR SYSTEM</u>	<u>PRESSURE CLASS</u>
Medium Pressure Supply (upstream of VAV box)	2 inch (500 Pa)
Low Pressure Supply (downstream of VAV box)	1 inch (250 Pa)
Return and Relief	1 inch (250 Pa)
General Exhaust	1 inch (250 Pa)
Outside Air Intake	1 inch (250 Pa)
Combustion Air	1 inch (250 Pa)

END OF SECTION

SECTION 15910

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers.
- C. Combination fire and smoke dampers.
- D. Duct access doors.
- E. Duct test holes.
- F. Fire dampers.
- G. Flexible duct connections.
- H. Smoke Dampers.
- I. Volume control dampers.

1.2 RELATED SECTIONS

- A. Section 15245 - Vibration Isolation.
- B. Section 15890 - Ductwork.
- C. Section 16180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- B. NFPA 92A - Smoke Control Systems.
- C. NFPA 70 - National Electrical Code.
- D. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- E. UL 33 - Heat Responsive Links for Fire-Protection Service.

- F. UL 555 - Fire Dampers and Ceiling Dampers.
  - G. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.
- 1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.
  - B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.
  - C. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.
- 1.5 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Section 15010.
  - B. Record actual locations of access doors, test holes, dampers, and air components.
- 1.6 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- 1.7 REGULATORY REQUIREMENTS
- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of Divisions 0 and 1.
  - B. Protect dampers from damage to operating linkages and blades.



PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Acceptable Manufacturers:
  - 1. Approved under provisions of Divisions 0 and 1.
- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS.

- A. Acceptable Manufacturers:
  - 1. Air Balance, Inc.
  - 2. Greenheck.
  - 3. Ruskin (Phillips Industries).
  - 4. Vent Products Co., Inc.
  - 5. Approved equal under provisions of Divisions 0 and 1.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage (1.6 mm) thick galvanized steel, with blades of maximum 6 inch (152 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree (1.57 Rad) stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
  - 1. Air Balance, Inc.
  - 2. Greenheck.
  - 3. Ruskin (Phillips Industries).
  - 4. Approved equal under provisions of Divisions 0 and 1.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.

- D. Multiple Blade Dampers: Fabricate with 16 gage (1.6 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3 x 13 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (13 mm) actuator shaft.
  - E. Operators: UL listed and labelled spring return, electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.
  - F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
  - G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices [to ensure positive closure for units mounted horizontally].
  - H. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.
- 2.4 DUCT ACCESS DOORS
- A. Acceptable Manufacturers:
    - 1. Air Balance, Inc.
    - 2. Cesco Products.
    - 3. Ruskin (Phillips Industries).
    - 4. Vent Products Co., Inc.
    - 5. Approved equal under provisions of Divisions 0 and 1.
  - B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
  - C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.

For insulated ductwork, install minimum one inch (25 mm) thick insulation with sheet metal cover.

1. Less Than 12 Inches (305 mm) Square: Secure with sash locks.
2. Up to 18 Inches (457 mm) Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 Inches (610 x 1220 mm): Three hinges and two compression latches.
4. Larger Sizes: Provide an additional hinge.
5. Sash Lock:
6. Compression Latch:
7. Hinge:

- D. Access doors with sheet metal screw fasteners are not acceptable.

## 2.5 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.6 FIRE DAMPERS

- A. Acceptable Manufacturers:
1. Air Balance, Inc.
  2. Greenheck.
  3. Ruskin (Phillips Industries).
  4. Approved equal under provisions of Divisions 0 and 1.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

- C. Ceiling Dampers: Galvanized steel, 22 gage (0.83 mm) frame and 16 gage (1.6 mm) flap, two layers 0.125 inch (3 mm) ceramic fiber on top side, with locking clip.
- D. Horizontal Dampers: Galvanized steel, 22 gage (0.83 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch WG (250 Pa) pressure class ducts below 12 inches (305 mm) in height.
- F. Multiple Blade Dampers: 16 gage (1.6 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3 x 13 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- G. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

## 2.7 FLEXIBLE DUCT CONNECTIONS

- A. Acceptable Manufacturers:
  - 1. Durodyne Corp.
  - 2. United McGill Corp.
  - 3. Approved equal under provisions of Divisions 0 and 1.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. Connector: Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq.yd (1.0kg/sq m).
  - 2. Net Fabric Width: Approximately 3 inches (76 mm) wide.
  - 3. Metal: 3 inch (76 mm)]wide, 24 gage (0.70 mm thick) galvanized steel.

- D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

## 2.8 SMOKE DAMPERS

### A. Acceptable Manufacturers:

- 1. Air Balance, Inc.
- 2. Ruskin (Phillips Industries).
- 3. Greenheck.
- 4. Approved equal under provisions of Divisions 0 and 1.

- B. Fabricate in accordance with NFPA 90A and UL 5555, and as indicated.

- C. Dampers: UL Class 1 curtain type fire damper, normally open automatically operated by electric actuator.

- D. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

## 2.9 VOLUME CONTROL DAMPERS.

### A. Manufacturers:

- 1. Air Balance, Inc.
- 2. Ruskin (Phillips Industries).
- 3. Greenheck.
- 4. Approved equal under provisions of Divisions 0 and 1.

- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

### C. Splitter Dampers:

- 1. Material: Same gage as duct to 24 inches (610 mm) size in either direction, and two gages heavier for sizes over 24 inches (610 mm).
- 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch (152 x 762 mm).
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (203 x 1829 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- F. End Bearings: Except in round ductwork 12 inches ([305] mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Quadrants:
  1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  3. Where rod lengths exceed 30 inches (762 mm) provide regulator at both ends.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

### 3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15890 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch (203 x 203 mm) size for hand access, 18 x 18 inch (457 x 457 mm)

size for shoulder access, and as indicated. Provide 4 x 4 inch (102 x 102 mm) for balancing dampers only. Review locations prior to fabrication.

- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 15245. For fans developing static pressures of 5.0 inches WG (1240 Pa) and over, cover connections with leaded vinyl sheet, held in place with metal straps.
- I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- J. Use splitter dampers only where indicated.
- K. Provide balancing dampers on high velocity systems where indicated. Refer to Section 15930 - Air Terminal Units.
- L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION





SECTION 15920  
SOUND ATTENUATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Duct Silencers.

1.2 RELATED SECTIONS

- A Section 07900 - Joint Sealers.
- B. Section 15890 - Ductwork: Connections to silencers.
- C. Section 15910 - Ductwork Accessories:  
Flexible duct connections.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A AABC - National Standards for Total System Balance.
- B AMCA 300 - Test Code for Sound Rating.
- C. AMCA 301 - Methods for Calculating Fan Sound Ratings from  
Laboratory Test Data.
- D. AMCA 302 - Application of Sound Loudness Ratings for  
Non-Ducted Air Moving Devices.
- E. AMCA 303 - Application of Sound Power Level Ratings for  
Ducted Air Moving Devices Recommended Typical dBa  
Calculation.
- F. ANSI S1.1 - Acoustical Terminology (Including Mechanical  
Shock and Vibration).
- G. ANSI S1.8 - Preferred Reference Quantities for Acoustical  
Levels.
- H. ANSI S1.13 - Methods for Measurement of Sound Pressure  
Levels.
- I. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- J. ARI 575 - Measuring Machinery Sound Within Equipment Rooms.

- K. ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
- L. ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
- M. ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
- N. ASHRAE 68 - Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
- O. ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
- P. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission of Building Partitions.
- Q. ASTM E477 - Method of Testing Duct Liner Materials and Prefabricated Silencers for Acoustical and Airflow Performance.
- R. ASTM E596 - Method for Laboratory Measurement of the Noise Reduction of Sound Isolating Enclosures.
- S. NEBB - Procedural Standards for Measuring Sound and Vibration.
- T. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

#### 1.4 DEFINITIONS

- A. Submittals and Report: Conform to ANSI S1.1.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- B. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook.

##### 1. Support Areas

- |                              |    |
|------------------------------|----|
| a) Meeting rooms             | 30 |
| b) Halls, corridors, lobbies | 35 |
| c) Service/support areas     | 40 |

2. Offices Areas

a) Executive	25
b) Conference rooms	25
c) Private	30
d) Open-plan areas	35
e) Computer/business machine areas	40
f) Circulation	40

3. Classroom Areas

a) Lecture and classrooms	25
b) Open-plan classrooms	30

4. Libraries 30

5. Assembly Areas

a) Assembly Halls	25
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1.6 SUBMITTALS: Submit under provisions of Section 15010.

- A. Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.
- B. Product Data: Provide catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance.
- C. Design Data: Provide engineering calculations, referenced to specifications and AMCA 301 standards indicating that maximum room sound levels are not exceeded.
- D. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers and that acoustic housings meet or exceed specified sound transmission loss values.
- E. Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.
- F. Manufacturer's Field Reports: Submit under provisions of Section 15010.
- G. Manufacturer's Field Reports: Indicate installation is complete and in accordance with instructions.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of duct silencers.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA 300 standards and recommendations of ASHRAE 68.
- B. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Design application of duct silencers under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Washington.

1.10 REGULATORY REQUIREMENTS

- A. Conform to applicable code for sound levels at property line.

PART 2 PRODUCTS

2.1 DUCT SILENCERS

- A. Acceptable Manufacturers:
  - 6. Rink Sound Control.
  - 2. Semco, Inc..
  - 3. Titus.
  - 4. United McGill Corp.
  - 5. Approved equal under provisions of Divisions 0 and 1.
- B. Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

- C. Configuration: Rectangular with lined splitters with radiused nose and contoured tails, of modular dimensions as scheduled on Mechanical drawings.
- D. Materials:
  - 1. Outer Casing: Minimum 22 gage (0.85 mm) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 2 inch (51 mm) long, 11 gage (3.1 mm) slip joints on both ends.
  - 2. Inner Casing and Splitters: Minimum 24 gage (0.7 mm) thick perforated galvanized steel.
  - 3. Fill: Glass fiber or mineral wool of minimum 4 lb/cu ft (64 kg/cu m) density.
  - 4. Fill Liner: Bonded glass fiber matting.
- E. Performance Rating, ASTM E477: See Sound Attenuator Schedule.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Support duct silencers independent of ductwork with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet. Refer to Section 15890 and 15910.

### 3.2 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Sections 15010, and Divisions 0 and 1.
- B. Inspect installation periodically under provisions of Section 15010, and Divisions 0 and 1.
- C. Provide services of AABC or NEBB testing agency to take noise measurement. Use meters meeting requirements of ASA 47 (ANSI S1.4).
- D. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations, as directed.

- E. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements.
- F. Submit complete report of test results including sound curves.

END OF SECTION

SECTION 15940

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.

1.2 RELATED SECTIONS

- A. Section 10211: Metal wall louvers.
- B. Section 09900 - Painting: Painting of ductwork visible behind outlets and inlets.

1.3 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- C. ARI 650 - Air Outlets and Inlets.
- D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- E. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- F. NFPA 70 - National Electrical Code.
- G. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of

outlets and inlets showing type, size, location, application, and noise level.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 15010.
- B. Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 RECTANGULAR CEILING DIFFUSERS

- A. Acceptable Manufacturers:
  - 1. Carnes Co.
  - 2. Krueger Mfg Co.
  - 3. Metalaire.
  - 4. Titus Products Div.
  - 5. Tuttle & Bailey.
  - 6. Approved equal under provisions of Divisions 0 and 1.
- B. Type: Square, adjustable pattern, stamped, multi-core diffuser to discharge air in two way, three way and four way pattern with sectorizing baffles where indicated.
- C. Frame: Surface mount or Inverted T-bar type as required for type of ceiling installed. Refer to Architectural Reflected Ceiling Plan.
- D. Fabrication: Aluminum with baked enamel off-white finish.



- E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

## 2.2 PERFORATED FACE CEILING DIFFUSERS

### A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire.
4. Titus Products Div.
5. Tuttle & Bailey.
6. Approved equal under provisions of Divisions 0 and 1.

- B. Type: Perforated face with fully adjustable pattern and removable face.

- C. Frame: Surface mount or Inverted T-bar type as required for type of ceiling installed. Refer to Architectural Reflected Ceiling Plan.

- D. Fabrication: Aluminum face with aluminum frame and baked enamel off-white finish.

- E. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

## 2.3 WALL SUPPLY REGISTERS/GRILLES

### A. Acceptable Manufacturers:

1. Carnes Co.
2. Krueger Mfg Co.
3. Metalaire.
4. Titus Products Div.
5. Tuttle & Bailey.
6. Approved equal under provisions of Divisions 0 and 1.

- B. Type: Streamlined and individually adjustable blades, [3/4 inch (19 mm)] minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, horizontal face, double deflection.
- C. Frame: 1 inch (25 mm) margin with countersunk screw mounting and gasket.
- D. Fabrication: Steel with 20 gage (1.00 mm) minimum frames and 22 gage (0.90 mm) minimum blades, steel and aluminum with 20 gage (1.00 mm) minimum frame, or aluminum extrusions, with factory off-white baked enamel finish.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

#### 2.4 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Acceptable Manufacturers:
  - 1. Carnes Co.
  - 2. Krueger Mfg Co.
  - 3. Metalaire.
  - 4. Titus Products Div.
  - 5. Tuttle & Bailey.
  - 6. Approved equal under provisions of Divisions 0 and 1.
- B. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, horizontal face.
- C. Frame: 1 inch (25 mm) margin with countersunk screw mounting.
- D. Fabrication: Extruded aluminum frame and blades, with factory off-white baked enamel finish.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09900.

END OF SECTION



SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING HVAC CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1989) Test Methods for Louvers, Dampers, and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 269 (1990a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM B 88 (1992) Seamless Copper Water Tube

ASTM D 635 (1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D 1693 (1970; R 1988) Environmental Stress-Cracking of Ethylene Plastics

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE-03 (1989) Handbook, Fundamentals I-P Edition

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-16 (1989; Addenda 1989, 1990, 1991) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASME B16.34 (1988) Valves - Flanged, Threaded, and Welding End

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

CODE OF FEDERAL REGULATIONS (CFR)

CFR 47 Part 15 Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power  
Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000  
Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1989) Installation of Air Conditioning and  
Ventilating Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA-07 (1983) HVAC Systems - Testing, Adjusting and  
Balancing

UNDERWRITERS LABORATORIES (UL)

UL 94 (1991) Tests for Flammability of Plastic  
Materials for Parts in Devices and Appliances

UL 268A (1983; Rev thru Mar 1986) Smoke Detectors for  
Duct Application

UL 555S (1983) Leakage Rated Dampers for Use in  
Smoke-Control Systems

UL 916 (1984) Energy Management Equipment

1.2 GENERAL REQUIREMENTS

A. Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a

product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

B. Identical Items

Items of the same classification as specified in PART 2 - PRODUCTS shall be identical, including equipment, assemblies, parts, and components.

C. Nameplates, Lens Caps, and Tags

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. Nameplates shall be mechanically attached to HVAC control panel interior doors. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each air flow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

D. Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

E. Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

F. Power-Line Surge Protection

All equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

G. Surge Protection for Transmitter and Control Wiring

All HVAC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

1. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

H. All Electronically operated equipment and controls covered by this section shall be year 2000 compliant.

1.3 SUBMITTALS:

A. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 15010 SUBMITTAL DESCRIPTIONS:

HVAC Control System Data.

Manufacturer's equipment data, product specific catalog cuts, and an ASME air-storage tank certificate. Catalog cuts shall be in booklet form indexed by device type. Where multiple components are shown on a catalog cut, the application-specific component shall be marked.

B. Training.

A training course in the maintenance and operation of the HVAC control systems specified, 60 days prior to the start of training. The training shall be oriented to the specific systems being installed under this



contract. One training manual shall be furnished for each trainee, plus two additional copies delivered for archival storage at the project site. The manuals shall include the agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Two copies of audiovisual materials shall be delivered for archival storage at the project site, either as a part of the printed training manuals or on the same media as that to be used during the training session.

C. Equipment.

The equipment data shall be in booklet form and indexed to the unique identifiers. Data sheets that document compliance with the specification and a copy of each HVAC control system bill of materials.

D. HVAC control system drawings.

Drawings shall include: a drawing index; a list of symbols; a series of drawings for each HVAC control system using abbreviations, symbols, nomenclature and identifiers as shown on the contract drawings; valve schedules; damper schedules; and a compressed-air station schematic on 34-inch by 22-inch (841 by 594 mm) sheets. All detail drawings shall be delivered together as a complete package. Valve and damper schedules may be submitted in advance but shall be included in the complete submittal. Each control-system element on a drawing shall have a unique identifier as shown.

E. Each series of drawings for an HVAC control system shall include a schematic as shown, a ladder diagram as shown, an equipment schedule as shown, a wiring diagram, a list of equipment with manufacturer and model number, a control-panel arrangement drawing, and an HVAC control-system sequence of operation.

F. The wiring diagram shall show the interconnection of conductors and cables to HVAC control-panel terminal blocks and to the identified terminals of starters and packaged equipment, with all necessary jumpers and ground connections. The wiring diagram shall show the labels of all conductors. All sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panelboard circuit breaker number, HVAC system control panel, magnetic starter, or packaged

control equipment circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

- G. The HVAC control-panel arrangement drawing shall show nameplate legends, fabrication details, and enclosure operating temperature-rise calculations. Fabrication details shall include interior door front and rear views, back panel layout and terminal block layout.
- H. The sequence of operation for each HVAC control system shall be in the language and format of this specification. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. The sequence of operation shall refer to each device by its unique identifier.
- I. The valve schedule shall include each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive-positioner range, and actuator size, supported by close-off pressure data, dimensions, operation rate, and access and clearance requirements data.
- J. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive-positioner ranges, locations of actuators and damper end switches, arrangement of sections in multisection dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum expected velocity through the damper at the intended location and the maximum leakage rate at the operating static-pressure differential. The damper schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements.
- K. Service Organization Instructions.

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name and telephone number.

#### L. Testing, Commissioning, and Balancing Reports

Six copies of the site testing procedures shall identify each item to be tested and shall clearly describe each test. The test procedures shall include a list of the test equipment to be used for site testing, manufacturer and model number, and the date of calibration and accuracy of calibration within 6 months of the test date. Six copies of the site testing data.

Original copies of all data produced during site testing, including results of each test procedure, after approval of the site tests. Six copies of the performance verification test plans and procedures. The test plan and procedures for the performance verification test, indexed and in booklet form, 60 days before scheduled test dates. Six copies of the performance verification test report, after completion of a successful test. Documentation of test results for the entire HVAC control system, complete and in booklet form and indexed, within 30 days after each test.

#### M. Testing, Commissioning, and Balancing Records

Six copies of the calibration, adjustment and commissioning report which shall include controller setpoints and proportional, integral and derivative-mode constant settings, calibration data for all instruments and controls, and all the data resulting from adjusting the control-system devices and commissioning HVAC control system.

#### N. Operation and Maintenance Manuals

VAC Control System;.

Six complete copies of operation manuals for each HVAC control system, in booklet form and indexed, outlining the step-by-step procedures required for each HVAC control system's startup, operation, and shutdown. The manuals shall include all detail drawings, equipment data, each controller's configuration check sheet and manufacturer supplied operation manuals for all equipment. Six complete copies of maintenance manuals, indexed in booklet form listing maintenance procedures.

The maintenance instructions shall include a maintenance check list for each HVAC control system. Maintenance manuals shall include spare parts data and recommended maintenance tool kits for all control devices. Maintenance instructions shall include

recommended repair methods, either field repair, factory repair, or whole-item replacement. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

#### O. Commissioning Procedures

Commissioning Procedures for each HVAC control system, and for each type of terminal-unit control system. The procedures shall reflect the language and format of this specification. The commissioning procedures shall refer to the devices by their unique identifiers as shown. The commissioning procedures shall include step-by-step configuration procedures for each controller. The configuration procedures shall be product specific and shall include a configuration check sheet showing all configuration parameters, dip switch settings, initial recommended P, I and D constants.

Six copies of Commissioning Procedures, 60 days prior to system commissioning, in booklet form and indexed, for each type of control device provided, such as controllers, pilot positioners, adjustable relays, and transmitters. Commissioning procedures shall include general instructions on how to set control parameters, including: setpoints; proportional, integral, and derivative mode constants; contact output settings for the specific devices provided. Commissioning procedures shall be specific to each HVAC system, shall detail the steps involved, and shall refer to the procedures in the booklet for specific devices.

#### 1.4 DELIVERY AND STORAGE

- A. Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

## PART 2 PRODUCTS

### 2.1 GENERAL EQUIPMENT REQUIREMENTS

#### A. Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have an enclosure NEMA 1 in accordance with NEMA 250 unless otherwise shown.

#### B. Standard Signals

The output of all analog transmitters and the analog input and output of all single-loop controllers and function modules shall be 4-to-20 mA DC signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

#### C. Ambient Temperature Limits

Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of plus 35 to 150 degrees F (2 to 49 degrees C). All panel-mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 35 to 150 degrees F (minus 37 to 66 degrees C).

### 2.2 MATERIALS

#### A. Tubing

##### 1. Copper

Copper tubing shall conform to ASTM B 88 and shall have sweat fittings and valves.

##### 2. Plastic

Plastic tubing shall have barbed fittings and valves. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with

ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

3. Stainless Steel

Stainless steel tubing shall conform to ASTM A 269, and shall have stainless steel compression fittings.

B. Wiring

1. Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2. Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 14 AWG minimum and shall be rated for 300-volt service.

3. Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 16 AWG minimum and shall be rated for 600-volt service.

4. Analog Signal Wiring Circuits

Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-volt service.

5. Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single or multiple-twisted, minimum 2-inch (51 mm) lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20-AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20-AWG tinned-copper cable drain wire, and overall cable insulation.

## 6. Nonconducting Wiring Duct

Nonconducting wiring duct in control panels shall have slotted sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips.

## 2.3 ACTUATORS

### A. General Requirements

Actuators shall fail to their spring-return positions as shown on signal or power failure and shall have a visible position indicator. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale input signal change. Electric or electronic actuators operating in parallel or in sequence shall have an auxiliary actuator driver. Actuators shall be electric or electronic as shown.

### B. Damper Actuators

Actuators shall smoothly operate the devices to which they are applied. Actuators shall fully open and close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. The actuator stroke shall be limited by an adjustable stop in the direction of power stroke. The actuators shall be provided with mounting and connecting hardware.

### C. Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

### D. Positive Positioners

Each positive positioner shall be a pneumatic relay with a mechanical feedback mechanism and an adjustable operating range and starting point.

## 2.4 AUTOMATIC CONTROL VALVES

### A. Valve Assembly

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping

insulation. Valve bodies shall be designed for not less than 125 psig (860 kPa) working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be .01 percent of rated Cv.

B. Butterfly-Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service, and for modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to 250 degrees F (minus 29 to 121 degrees C).

Valves shall have a manual means of operation independent of the actuator.

C. Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

D. Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

E. Valves for Chilled-Water, Condenser-Water, and Glycol Service

Bodies for valves 1-1/2 inches (38mm) and smaller shall be brass or bronze, with threaded or union ends.

Bodies for valves from 2 inches to 3 inches (50mm to 80mm) inclusive shall be of brass, bronze or iron.

Bodies for 2-inch (50mm) valves shall have threaded ends. Bodies for valves from 2-1/2 inches to 3 inches (65mm to 80mm) shall have flanged-end connections.

Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal valve trim shall be brass or bronze except that valve stems may be type 316 stainless steel. Valves 4 inches (102mm) and larger shall be butterfly valves.

F. Valves for Hot-Water Service Below 250 Degrees F (121 Degrees C)

Bodies for valves 1-1/2 inches (38mm) and smaller shall be brass or bronze, with threaded or union ends.

Bodies for 50 mm 2-inch (51mm) valves shall have threaded ends. Bodies for valves from 2 inches to 3



inches (50mm to 80mm) inclusive shall be of brass, bronze, or iron. Bodies for valves 4 inches (102mm) and larger shall be iron. Bodies for valves 2-1/2 inches (64mm) and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F (99 degrees C) shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F (99mm) or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F (121 degrees C) or 50 degrees F (\_\_\_ degrees C) above the system design temperature, whichever is higher. Valves 4 inches (102mm) and larger shall be butterfly valves.

## 2.5 DAMPERS

### A. Damper Assembly

A single damper section shall have blades no longer than 48 inches (1219mm) and shall be no higher than 72 inches (1829mm). Maximum damper blade width shall be 8 inches (203mm). Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 0.5-inch (13mm) minimum plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge (10Pa) at 1,000 fpm (5m/s) in the wide-open position. Frames shall not be less than 2 inches (51mm) in width. Dampers shall be tested in accordance with AMCA 500.

#### 1. Operating Links

Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless

steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

## 2. Damper Types

Dampers shall be parallel blade type.

### B. Outside-Air, Return-Air, and Relief-Air Dampers

The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot (102 L/S per square meter) at 4 inches water gauge (1000 Pa) static pressure when closed. Seals shall be suitable for an operating temperature range of 40 degrees F to 200 degrees F (minus 40 degrees C to 93 degrees C). Dampers shall be rated at not less than 2000 fpm (10/m/s) air velocity.

### C. Mechanical and Electrical Space Ventilation Dampers

The dampers shall be as shown. Dampers shall not leak in excess of 80 cfm per square foot (406 L/S per square meter) at 4 inches (995Pa) water gauge static pressure when closed. Dampers shall be rated at not less than 1500 fpm (7.8 m/s) air velocity.

### D. Smoke Dampers

Smoke-damper and actuator assembly required per NFPA 90A shall meet the Class II leakage requirements of UL 555S. Dampers shall be rated at not less than 2000 fpm (10 m/s) air velocity.

### E. Damper End Switches

Each end switch shall be a hermetically-sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

## 2.6 DUCT SMOKE DETECTORS

- A. Duct smoke detectors shall be provided in supply and return air ducts in accordance with NFPA 90A. Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 500 fpm (25 m/s) and 4000 fpm (20 m/s). Detectors shall be powered from the HVAC control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as the affected fan unit(s) shall be properly identified in etched rigid plastic placards.

## 2.7 INSTRUMENTATION

### A. Measurements

Transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for an output of 4 to 20 mAdc:

1. Conditioned space temperature, from 50 to 85 degrees F (10 to 29 degrees C).
2. Duct temperature, from 40 to 140 degrees F (5 to 60 degrees C) except that return-air temperature for economizer operation shall be minus 30 to plus 130 degrees F (minus 34 to 54 degrees).
3. Chilled-water temperature, from 30 to 100 degrees F (minus 1 to 38 degrees C).
4. Heating hot-water temperature, from 100 to 250 degrees F (38 to 121 degrees C).
5. Outside-air temperature, from minus 30 to 130 degrees F.

6. Relative humidity, 0 to 100 percent for space and high-limit applications (minus 34 to 54 degrees C).
7. Differential pressure for VAV supply-duct static pressure from 0 to 2.0 inches water gauge (0 to 500 Pa).
8. Pitot-tube air-flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 700 to 1200 fpm (3.6 to 6.1 m/s), 0 to 0.25 inch (water gauge (0 to 62 Pa) for velocities of 700 to 1800 fpm (3.6 to 9.1 m/s), or 0 to 0.5 inch water gauge (0 to 125 Pa) for velocities of 700 to 2500 fpm (3.6 to 12.7 m/s).
9. Electronic air-flow measurement station and transmitter, from 125 to 2500 fpm (0.63 to 12.7 m/s).

B. Temperature Instruments

1. Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3-wire RTD.

Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 32 degrees F (0 degrees C), and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally-mounted unless otherwise shown.

2. Continuous-Averaging RTD

Continuous-averaging RTDs shall have a tolerance of plus or minus 1.0 degree F (0.6 degree C) at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross-section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter as specified, to match the resistance range of the averaging RTD.

3. RTD Transmitter

The RTD transmitter shall accept a 3-wire 100 ohm RTD input. The transmitter shall be a 2-wire,

loop-powered device. The transmitter shall produce a linear 4-to-20 mA<sub>dc</sub> output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

C. Relative-Humidity Instruments

A relative-humidity instrument for indoor application shall have a measurement range from 0 to 100 percent relative-humidity and be rated for operation at ambient air temperatures within the range of 25 to 130 degrees F (minus 4 to 54 degrees C). It shall be capable of being exposed to a condensing air stream (100 percent RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The instrument shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. A duct-mounted instrument shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. The instrument (sensing element and transmitter) shall be a 2-wire, loop-powered device and shall have an accuracy of plus or minus 2 percent of full scale within the range of 20 to 90 percent relative humidity. In the range of 90 to 100 percent relative humidity, the instrument's accuracy shall be within plus or minus 3 percent of full scale. The instrument shall have a typical long-term stability of 1 percent or less drift per year. The transmitter shall convert the sensing element's output to a linear 4-20 mA<sub>dc</sub> output signal in proportion to the measured relative-humidity value. The transmitter shall include offset and span adjustments.

D. Electronic Air-Flow-Measurement Stations and Transmitters

1. Stations

Each station shall contain an array of velocity sensing elements inside a flanged sheet-metal casing. The velocity sensing elements shall be of the RTD or thermistor type, with linearizing means. The sensing elements shall be distributed across the duct cross-section in the quantity and pattern set forth for measurements and instruments of ASHRAE-03 and SMACNA-07 for the traversing of ducted air flows. The resistance to air flow

through the air-flow measurement station shall not exceed 0.08 inch water gauge (19.9 Pa) at an air flow of 2000 fpm (10.2 m/s). Station construction shall be suitable for operation at air flows of up to 5000 fpm (25.4 m/s) over a temperature range of 40 to 120 degrees F (4.4 to 49 degrees C), and accuracy shall be plus or minus 3 percent over a range of 125 to 2500 fpm (0.63 to 12.7 m/s) scaled to air volume.

## 2. Transmitters

Each transmitter shall produce a linear, temperature compensated 4-to-20 mAdc output corresponding to the required velocity measurement. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement. Each transmitter shall have offset and span adjustments.

### E. Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure.

The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement. Each transmitter shall have offset and span adjustments.

### F. Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2-inch (51mm) lagging neck and extension-type well, and inside diameter and insertion length as required for the application.

### G. Sunshields

Sunshields for outside-air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized-metal rainshield projecting over the face of

the sunshield. The sunshields shall be painted white or shall be unpainted aluminum.

## 2.8 THERMOSTATS

### A. General

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F (5 degrees C) of the setpoint shown. Thermostats shall be electronic or low-voltage electric.

### B. Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F (2.8 degrees C). Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

### C. Microprocessor-Based Room Thermostats

Microprocessor-based thermostats shall have built-in keypads for scheduling of day and night temperature settings. [Access to the scheduling mode shall be by a password control code.] When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF setpoints for all 7 days of the week. The time program shall allow 2 separate temperature-setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for 1 year in the event of a power outage. Maximum differential shall be 2 degrees F (1.1 degrees C). When used for heat-pump applications, the thermostat shall have an emergency heat switch.

D. Modulating Room Thermostats

These thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F (2.2 to 4.4 degrees C) for each output. Room thermostats shall be enclosed with separate locking covers (guards).

E. Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 5 feet (1.5m), shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F (3.3 to 8.9 degrees C). Aquastats shall be of the strap-on type, with 10 degrees F (5.6 degrees C) fixed differential.

F. Low-Temperature-Protection Thermostats

Low-temperature-protection thermostats shall be, low-temperature safety thermostats, with NO and NC contacts and a 20-foot (6.1m) element which shall respond to the coldest 18-inch (457mm) segment.

G. Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F (2.2 to 4.4 degrees C) for each output.

2.9 PRESSURE SWITCHES AND SOLENOID VALVES

A. Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

B. Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with 2 SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings



designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. Range shall be 0.5 to 6.0 inches water gauge (125 to 1490 Pa). Differential shall be a maximum of 0.15 inch water gauge (37Pa) at the low end of the range and 0.35 inch water gauge (87 Pa) at the high end of the range.

## 2.10 INDICATING DEVICES

### A. Thermometers

#### 1. Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9-inch (229mm) scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

#### 2. Piping System Thermometer Stems

All thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

#### 3. Non-Averaging Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree (0.79 rad) adjustable duct flanges with locking mechanism.

#### 4. Averaging Air-Duct Thermometers

Averaging thermometers shall have no less than 3-1/2 inch (89mm) dial, with black legend on white background, and pointer traveling through a 270-degree arc (4.7 rad).

#### 5. Accuracy

Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have a range suitable for the application.

B. Pressure Gauges

Gauges shall be 2 inch (51mm) nominal size, back-connected, suitable for field or panel mounting as required, shall have black legend on white, background, and shall have a pointer traveling through a 270-degree (4.7 rad) arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of ASME B40.1.

1 Hydronic-System Gauges

Gauges for hydronic-system applications shall have ranges and graduations as shown.

C. Low Differential Pressure Gauges

Gauges for low differential-pressure measurements shall be 4-1/2 inch (115mm) nominal size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus 2 percent of scale range.

2.11 SINGLE-LOOP CONTROLLERS

A. Controller Features

The controller shall be a microprocessor-based single-loop device that does not require Contractor-generated software. The controller shall meet CFR 47 Part 15, for Class A computing devices. The controller panel cutout shall be 3.62 inches by 3.62 inches (92mm x 92mm). The controller shall have field scalable process variable, a remote setpoint analog input and an analog output with adjustable high and low end limits and proportional control manual reset adjustment. The analog output shall result from proportional, integral and derivative (PID) control. The analog output shall be configurable as direct acting and reverse acting. The controller shall have keyboard, display, auto/manual selection for control of its analog output, remote setpoint adjustment/local setpoint adjustment selection with adjustable high-end and low-end limits, ratio and bias adjustments on remote setpoint input, operator-initiated self-tune/manual-tune selection, anti-reset wind-up feature, and 2 independent SPDT contact-closure outputs (PV alarm and PV deviation alarm). The controller

shall be configurable to power-up in manual with local setpoint control, in automatic with local setpoint control and in automatic with remote setpoint control.

The range of hysteresis adjustment shall be not smaller than from 1 percent to 5 percent of process variable input span. The controller shall power the analog output loop to 20 milliamperes when connected to a load of 600 ohms. The controller shall be capable of retransmitting the process variable to 20 milliamperes when connected to 600 ohms. The controller shall have 5-year battery backup to store operating parameters or shall have nonvolatile memory.

B. Parameter Input and Display

All control parameters shall be entered and displayed directly, in the correct engineering units, through a series of keystrokes on a front-panel display with a 3-1/2 digit, 7-segment display, with decimal point and polarity indication. The use of this display shall allow manual interrogation of setpoint, mode constants, and values of the process variable and output.

C. Controller Electrical Requirements

Each controller shall be powered by 120 volts ac. Power consumption shall not be greater than 20 watts. Each controller shall provide electrical noise isolation between the ac power line and the process variable input, remote setpoint input, and output signals and of not less than 100 db at 60 Hz common-mode rejection ratio, and not less than 60 db at 60 Hz normal-mode rejection ratio.

D. Controller Accuracy

The controller shall have an accuracy of plus or minus 0.30 percent of input span, plus or minus 1 digit.

E. Self-Tuning

The controller self-tuning operation shall apply proportional, integral, and derivative modes of control and shall modify the mode constants as required. Self-tuning shall only be in operation when selected from the front panel.

F. Manual-Tuning

The controller manual-tuning operation shall provide proportional, integral, and derivative control modes, or any combination thereof, by means of individual mode constant adjustments. These adjustments shall be set for the appropriate value if a particular control mode action is desired, or to zero if that particular mode is not desired. The proportional-mode constant shall be adjustable from 0 to 200 percent of input signal range, the integral-mode constant shall be adjustable from 0 to 20 repeats per minute, and derivative-mode constant shall be adjustable from 0 to 5 minutes.

2.12 CONTROL DEVICES AND ACCESSORIES

A0 Except where otherwise specified, control device and accessory input impedance shall not exceed 250 ohms.

B. Function Modules

Function modules shall accept mAdc analog input signals to produce mAdc analog output signals or contact output signals. Modules shall have zero and span adjustments for analog outputs, and setpoint adjustments for contact outputs. Module output span accuracy shall be plus or minus 1 percent of input span. Modules shall be rail-mounted as shown. Power consumption shall not be greater than 5 watts.

1. Minimum-Position Switch and Temperature-Setpoint Device

Minimum-position switch and temperature-setpoint device shall accept a 1000 ohms potentiometer input and shall produce a steady analog output. In temperature setpoint applications the potentiometer shall be single-turn, suitable for wall mounting, enclosed in a locking metal or heavy duty plastic enclosure and shall have a graduated dial corresponding to the range of the setpoint adjustment. In a minimum position switch application the potentiometer shall be mounted on or internal to the minimum position switch. The device shall have its input signal electrically or optically isolated from output. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2. Signal-Inverter Modules

Signal inverter shall accept an analog input signal and shall have sufficient output capacity to drive the output signal through a circuit with an impedance of not less than 600 ohms. The output shall be electrically isolated from the input and the device shall have a moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

3. High-Low Signal Selector

High-low signal-selector modules shall accept analog input signals and select either the highest or the lowest input signal as the output signal.

The signal selector shall be powered by 120 Vac and the output signal shall be electrically isolated from the input signal.

4. Sequencer Modules

Sequencer modules shall provide fixed time-delayed sequencing of one or more contact transfers from an analog input signal. Sequencers shall return all contacts to their zero input signal condition when power is interrupted.

5. Loop Driver Modules

Loop driver module shall accept an analog input signal and shall have a circuit input impedance not greater than 100 ohms. The loop driver module shall have sufficient output capacity to drive the output signal through a circuit with an impedance range of not less than 1000 ohms. The output shall be electrically isolated from the input and the device shall have moisture resistant coating.

Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8 output signal.

C. Relays

Relays shall be 2-pole, double-throw (2PDT) with a 10-ampere resistive rating at 120 Vac, and shall have an enclosed 120-Vac coil with 8-pin blade connectors, and a matching rail-mounted socket. Power consumption shall not be greater than 3 watts.

D. Time-Delay Relays

Time delay relays shall be 2PDT with 8-pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 3 minutes. Power consumption shall not be greater than 3 watts.

E. Time Clocks

Each time clock shall be a 365-day programmable timing device with 4 independently timed circuits. Each clock shall have a manual scheduling keypad and an alphanumeric display of all timing parameters. Timing parameters shall include: date in Gregorian calendar for month, day and day-of-month indication; and 24-hour time-of-day display, with one-minute resolution for programming the ON and OFF times for each circuit. Each clock shall allow programming of each circuit for 12 holiday periods for either ON or OFF events for any selected duration of the 365-day program. Each clock shall have capacity for programming 4 ON events and 4 OFF events for each circuit. The programmed events shall be assignable to a 365-day schedule. Each clock shall have automatic Standard Time and Daylight Saving Time adjustment, by input of the appropriate dates. Each time clock shall have automatic leap year correction. Each clock shall be provided with 4-day battery backup. Power consumption shall not be greater than 10 watts.

F. Regulated Power Supplies

Each power supply shall provide a 24-Vdc linear supply at not less than 2 amperes, with regulation to 0.05 percent of output voltage. Each power supply shall have a fused input, and shall be protected from voltage surges and power-line transients. The power supply output shall be protected against overvoltage and short circuits. Power supply loading shall not be greater than 1.2 amperes.

G. Power Line Conditioner (PLC)

PLCs shall be furnished for each controller panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferroresonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The PLCs shall be sized for 125 percent of the actual connected kva load. Characteristics of the PLC shall be as follows:

1. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal voltage when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal voltage.
2. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.
3. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

#### 2.13 PILOT LIGHTS AND MANUAL SWITCHES

A0 Pilot lights and switches shall be rectangular devices arranged in a horizontal matrix as shown. Momentary switches shall be non-illuminated. Interlocking switches shall have separately illuminated sections. Device illumination shall be by light-emitting diode or neon lamp.

#### 2.14 HVAC SYSTEM CONTROL PANELS

##### A0 Panel Assembly

- 1 The panel shall be fabricated as shown, and the devices shall be mounted as shown. Each panel shall be fabricated as a bottom-entry connection point for control-system electric power, control-system main air source, control-system wiring, pneumatic tubing, interconnection of control systems, interconnection of starters and external shutdown devices, and energy monitoring and control systems (EMCS) interface. Each panel shall have an operating temperature rise of not greater than 20 degrees F (11 degrees C) above an ambient temperature of 100 degrees F (38 degrees C). The control panel shall be factory assembled and shipped to the job site as a single unit.

##### B. Panel Electrical Requirements

Each control panel shall be powered by nominal 120 volts ac terminating at the panel on terminal blocks.

Instrument cases shall be grounded. Interior panel, interior door, and exterior panel enclosure shall be grounded.

C. Enclosure

The enclosure for each panel shall be a NEMA 12 single-door wall-mounted box conforming to NEMA 250, with continuous hinged and gasketed exterior door with print pocket and key lock, continuous hinged interior door, interior back panel, and ventilation louvers in back surface as shown. Inside finish shall be white enamel, and outside finish shall be gray primer over phosphatized surfaces.

D. Mounting and Labeling

Controllers, pilot lights, switches, IP's, and pressure gauge shall be mounted on the interior door as shown. Power conditioner, fuses and duplex outlet shall be mounted on the interior of the cabinet as shown. All other components housed in the panel shall be mounted on the interior back panel surface of the enclosure, behind the door on rails as shown. Controllers and gauges shall be identified by a plastic or metal nameplate that is mechanically attached to the panel. The nameplate shall have the inscription as shown. Lettering shall be cut or stamped into the nameplate to a depth of not less than 1/64 inch (0.4mm), and shall show a contrasting color, produced by filling with enamel or lacquer or by the use of a laminated material. Painting of lettering directly on the surface of the interior door or panel is not permitted.

E. Wiring and Tubing

1. Wiring Interconnections

Wiring shall be installed in wiring ducts in such a way that devices can be added or replaced without disturbing wiring that is not affected by the change. Wiring to all devices shall have a 4-inch (102mm) wiring loop in the horizontal wiring duct at each wiring connection. There shall be no wiring splices within the control panel. All interconnections required for power or signals shall be made on device terminals or panel terminal blocks, with not more than 2 wires connected to a terminal.



## 2 Terminal Blocks

Terminal blocks shall be arranged in groups as shown. Instrument signal grounds at the same ground reference level shall end at a grounding terminal for connection to a common ground point.

Wiring-shield grounds at the same reference level shall end at a grounding terminal for connection to a common ground point. Grounding terminal blocks shall be identified by reference level.

## 3 Wiring Identification

All wiring connected to controllers, time clocks and function modules shall be identified by function and polarity with full word identifiers, i.e., process variable, input, remote setpoint input and control output.

### F. EMCS Terminal Blocks

Terminal blocks shall be provided for connections to EMCS as shown. Analog signals shall require only the removal of jumpers to interface to EMCS.

## 2.15 ELECTRONIC VARIABLE AIR VOLUME (VAV) TERMINAL UNIT CONTROLS

### A. VAV Terminal Units

The VAV terminal units shall be as specified in Section 15895 AIR-SUPPLY AND DISTRIBUTION SYSTEM (FOR AIR-CONDITIONING SYSTEM).

#### 1. Terminal-Unit Controls

##### a. Box Control Device

[Controls for pressure-independent boxes shall consist of a velocity-sensing device in the primary air entering the box, a room temperature sensing element, a damper actuator, and an adjustable microprocessor-based VAV box controller. Each controller shall operate a damper for cooling [and a duct coil for heating]. Actuator shall open or close the device to which it is applied within 6 minutes. Terminal unit controls shall meet the requirements of UL 916 and CFR 47 Part 15.]

## 2. Communication-and-Programming Device

One hand-held communication-and-programming device with instruction manual, plus one additional hand-held communicating device and instruction manual per 100 terminal units, shall be provided.

The communication-and-programming device shall connect to the controller directly or to a jack at the room-temperature-sensing element location. The communication-and-programming device shall be used to read and set minimum velocity, maximum velocity, heating setpoint, and cooling setpoint, and to read velocity and space temperature.

### 2.17 MANUAL EMERGENCY FAN SHUTOFF SWITCHES

- A0 Manual emergency fan shutdown switches shall be provided for air distribution fan in accordance with NFPA 90A. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 48 inches (1219 mm) above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

### 2.18 INDOOR AIR QUALITY SENSOR

- A. The Indoor air Quality Sensor shall be equal to Model No. FRA-Q1 as manufactured by Staefa Control Systems.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION CRITERIA

- A0 The HVAC control system shall be completely installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control-system installation shall provide clearance for control-system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control-system devices. The control-system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

B. Device-Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturers' recommendations and as shown.

Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

C. Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC control panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Cables and conductors wires shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

D. Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL-SYSTEM INSTALLATION

A0 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

B0 Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 5 feet (1.5m) above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

C. Low-Temperature-Protection Thermostats

For each 20 square feet (1.8 square meters) of coil-face area, or fraction thereof, a thermostat shall be provided to sense the temperature at the location shown. The thermostat sensing element shall be installed in a serpentine pattern.

D. Averaging-Temperature Sensing Elements

Sensing elements shall have a total-element minimum length equal to one linear foot per square foot (3.3 linear meter per square meter) of duct cross-sectional area.

E. Duct Static-Pressure Sensing Elements and Transmitters

The duct static-pressure sensing element and transmitter sensing point shall be located approximately two-thirds of the distance from the supply fan to the end of the duct with the greatest pressure drop.

F. Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.3 CONTROL SEQUENCES OF OPERATION

A0 General Requirements

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

1 HVAC System Supply Fan Operating

HVAC system outside-air, return-air, and relief-air dampers shall function as described hereinafter for specific modes of operation unless control of the dampers is assumed by the fire and smoke control system. Smoke dampers shall open before fans are allowed to start. Interlocked exhaust fans shall be stopped in the unoccupied mode and their dampers shall be closed. Interlocked exhaust fans shall run in the occupied mode, and their dampers shall open. Cooling-coil control valves and cooling-coil circulating Pumps shall function as described hereinafter for the specific modes of operation unless their control is assumed by the freeze-protection system. Heating coil valves shall be under control.

2 HVAC System Supply Fan Not Operating

When an HVAC system is stopped, all interlocked fans shall stop, the smoke dampers shall close, the outside-air and relief-air dampers shall close, the return-air damper shall open, all stages of direct-expansion cooling shall stop, the system shall pump down if it has a pump down cycle, and all cooling-coil valves for coils located indoors shall close to the coil. Cooling-coil valves of units located outdoors shall open to the coil. Heating-coil valves shall remain under control.

B0 Unit-Heater and Cabinet-Unit-Heater

All Modes - A wall-mounted thermostat with an "AUTO-OFF" switch located as shown, shall cycle the fan to maintain its setpoint as shown when the switch is in the "AUTO" position. When the switch is in the "OFF" position, the fan shall be stopped.

C0 Single Building Hydronic Heating with Hot Water Boiler

- 1 All Modes - The outside-air temperature controller shall accept a signal at its process variable input from a sunshielded outside-air temperature sensing element and transmitter located as shown. The analog output of the controller shall send a signal to the remote setpoint input of the primary hydronic-heating system temperature controller to

schedule the hydronic-heating supply temperature in a linear schedule as shown. The selection of the sequence of boilers to be used shall be made by the operator. Once the selection is made, the outside-air temperature controller process variable relay contact output shall start and stop the appropriate pumps and Boiler at the outside-air temperatures as shown. The hydronic-heating supply temperature controller shall accept a signal at its process variable input from a temperature sensing element and transmitter located in the hydronic-heating supply line and the controller output shall modulate the hydronic-heating system control valve to maintain the setpoint in the hydronic-heating supply line.

- 2 Occupied Mode - When the clock places the system in the occupied mode, a space-temperature sensing element and transmitter located as shown shall signal a space-temperature controller which shall maintain the setpoint as shown by modulating the secondary-hydronic-system zone valve. In this mode of operation, the controller setpoint shall be adjustable from the sensor and transmitter location. Unoccupied Mode - When the clock places the system in the unoccupied mode, the setpoint of the controller shall be as shown and shall be adjustable at the HVAC control panel.

D0 Single Building Hydronic Cooling with Air-Cooled Chiller

- 1 Occupied Mode - The selection of the sequence of chillers to be used shall be made by the operator. When the clock places the system in the occupied mode, the system shall automatically perform everything required to bring on each chiller and its associated systems. The system shall continuously monitor the total BTU needs of the system and shall start and stop each chiller automatically as the building load changes. Prior to starting any chiller, the system shall open the chiller's respective chilled water blocking valve and select and start the appropriate chilled water pump. The system shall automatically detect the failure of any pump, signal an alarm and start the standby pump. A space-temperature sensing element and transmitter shall signal a space-temperature controller which shall maintain the setpoint as shown by modulating the secondary-hydronic-system

zone valve. In this mode of operation, the controller setpoint shall be adjustable from the sensor and transmitter location. Unoccupied Mode - When the clock places the system in the unoccupied mode, the setpoint of the controller shall be adjustable at the HVAC control panel.

E0 Variable-Air-Volume Control Sequence with Return Fan

1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The clock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the clock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the clock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the clock shall open the contact to turn off the occupied mode pilot light and shall place the control system in the unoccupied mode of operation.

2 Outside-Air, Return-Air, and Relief-Air Dampers

Occupied Mode: The outside air damper shall open to provide minimum CFM. Minimum outside air damper and the relief damper shall modulate to maintain minimum volume setpoint. The return air damper shall remain open except when operating in economy cycle. Unoccupied and Ventilation-Delay Modes The dampers shall return to their normal positions.

3 Supply-Fan and Return-Fan Control

Occupied and Ventilation-Delay Modes - The variable Frequency Drives (VFD) for the supply and return fans shall be enabled by time of day schedule and shall always start at minimum setting and shall ramp up to required speed at an adjustable rate. When the unit fan is started, the associated exhaust fans shall be interlocked to start. The unit fans= speed shall be controlled in response to a static pressure sensor

in the supply air (mounted approximately 2/3 of the way downstream from the fan) to maintain sufficient static pressure for the VAV terminals.

Unoccupied Mode - The supply fan and the return fan shall cycle from a night thermostat.

4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

5 Low-Temperature-Protection Thermostat

All Modes - A thermostat in the entering air of the cooling coil shall stop the supply fan and the return fan, and shall turn on the low-temperature pilot light if the temperature drops below the setpoint as shown.

Restarting the supply fan and the return fan and turning off the pilot light shall require manual reset at the thermostat and at the HVAC control panel.

6 Cooling Coil

Occupied and Ventilation-Delay Modes - The cooling coil temperature controller shall modulate the control valve from the signal of a temperature sensor and transmitter in the fan discharge to maintain the setpoint as shown. Unoccupied Mode - The temperature-controller output signal shall be interrupted and the cooling-coil control valve shall be closed.

7 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input and shall accept the signal of a return-air temperature-sensing element and transmitter and its process variable input. The economizer controller shall perform switch over to outside-air economizer control mode and minimum outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the



minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on. When the economizer controller places the control system in the minimum outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

8 Mixed-Air Temperature Control

When the economizer controller places the control system in the economizer mode, the mixed-air temperature controller shall modulate the dampers from the signal of a temperature sensing element and transmitter in the mixed air to maintain the setpoint as shown.

9 Pressure-Independent Terminal VAV Box with Velocity

All Modes - The control damper of the VAV box shall modulate in response to the signal from a flow-sensing element at the discharge or inlet of the VAV box to a microprocessor-based VAV-box velocity controller. The velocity controller shall control the box damper from the minimum-flow position to the full-flow position from the signal of a space-temperature sensing element located as shown. When the space temperature decreases, the damper shall gradually close to the minimum-flow position to maintain the cooling setpoint as shown. When the space temperature calls for heating after the minimum-flow position is reached, control shall then pass through a temperature dead band as shown. When the space temperature has dropped through the dead band, the duct heater coil shall be gradually controlled to maintain the heating setpoint as shown.

10 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

F0 Single-Zone with Hydronic Heating/Cooling Coils  
with Return Fan

1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay-mode timing shall start prior to the occupied-mode timing. The clock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the clock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the clock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the clock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

2 Outside-Air, Return-Air, and Relief-Air Dampers  
Occupied Mode: Provide an indoor air quality sensor located as shown to modulate the outside air damper open anytime undesirable indoor air quality conditions exist. The setpoint shall be adjustable. The return air damper shall remain open except when operating in economy cycle. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions as shown.

3 Supply-Fan and Return-Fan Control

Occupied and Ventilation-Delay Modes: The Variable Frequency Drives (FVD) for the supply and return fans shall be enabled by time of day schedule and

shall always start at minimum setting and shall ramp up to required speed at an adjustable rate. When the unit fan is started, the associated exhaust fans shall be interlocked to start. The unit fans= speed shall be controlled in response to a static pressure sensor in the supply air (mounted approximately 2/3 of the way downstream from the fan) to maintain sufficient static pressure for the VAV terminals. Supply Fan and Return-Fan shall start, and shall operate continuously. Unoccupied Mode - The supply fan and the return fan shall cycle from a night thermostat.

4 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

5 Low-Temperature-Protection Thermostat

All Modes - A thermostat in the entering-air side of the cooling coil shall stop the supply fan and return fan and shall turn on the low-temperature pilot light if the temperature drops below the setpoint as shown. Restarting the fans and turning off the pilot light shall require manual reset at the thermostat and at the HVAC control panel.

6 Hydronic Cooling Coil

Occupied and Ventilation-Delay Modes The control valve shall be modulated by the space-temperature controller. Unoccupied Mode - The temperature-controller output signal shall be interrupted and the cooling-coil control valve shall be closed.

7 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input and shall accept the signal of a return-air temperature-sensing element and transmitter and its process variable input. The economizer controller shall perform switch over to

outside-air economizer control mode and minimum outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on.

8 Space-Temperature-Sequenced Heating and Cooling Control

When the economizer controller places the control system in the economizer mode, a space-temperature sensing element and transmitter operating through a space-temperature controller shall first gradually shut off the heating-coil valve. After the controller output passes through a deadband, the controller shall then gradually operate the outside-air damper to admit outside air beyond the minimum quantity while simultaneously operating the cooling-coil valve to maintain the setpoint as shown. When the economizer controller places the control system in the minimum-outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

The space-temperature sensing element and transmitter operating through the space-temperature controller shall, on a rise in space temperature, first gradually shut off the heating-coil valve. After the controller output passes through a deadband, the controller shall then gradually open the cooling-coil valve to maintain the setpoint as shown.

9 Emergency Fan Shutdown

Activation of a duct smoke detector in the supply-air or return-air ductwork, or activation of a manual emergency fan shutdown switch shall cause the associated fan to shutdown in accordance

with NFPA 90A. Activation of these devices shall operate a pilot light on the HVAC control panel. The panel shall require manual resetting after the detector and the manual switch are reset.

### 3.4 COMMISSIONING PROCEDURES

#### A0 General Procedure

##### 1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the clock schedule, and make any necessary control-system corrections to ensure that the systems function as described in the sequence of operation. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

##### 2 Item Check

An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. Signals used to change the mode of operation shall originate from the actual HVAC control device intended for the purpose, such as the time clock. External input signals to the HVAC control panel (such as EMCS, starter auxiliary contacts, and external systems) may be simulated in Steps 1, 2, and 3. With each operational-mode change signal, Pilot lights and HVAC-panel output-relay contacts shall be observed to ensure that they function. All terminals assigned to EMCS shall be checked and observed to ensure that the proper signals are available.

##### 3 Weather-Dependent Test Procedures

Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used,

the Contractor shall verify the actual results in the appropriate season.

4 Configuration

The Contractor shall configure each controller for its specified service.

5 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC-control-system sensing element and transmitter shall be performed by comparing the HVAC-control-panel readout to the actual value of the variable measured at the sensing element and transmitter or air-flow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-controller readout accuracy. The calibration of the test instruments shall be traceable to NBS standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-controller readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

6. Insertion, Immersion Temperature

Insertion-temperature and immersion-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

7. Averaging Temperature

Averaging-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked every 2 feet (610 mm) along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

## 8. Controller Stations

The Contractor shall use the controllers' MANUAL/AUTOMATIC stations as the means of manipulating control devices, such as dampers and valves, to check IP operation and to effect stable conditions prior to making measurement checks.

## 9. Controller-Tuning Procedure

The Contractor shall perform a controller-tuning procedure, which shall consist of setting the initial proportional, integral, and derivative (PID) mode constants, controller setpoints, and logging the settings. Tuning shall be self-tuning operation by the controller unless manual tuning is necessary.

## 10. Controller Manual-Tuning Procedure

Where required, the controller manual-tuning procedure shall be performed in three steps. Using a constant-temperature-setpoint controller as an example, these steps are:

### a. Step A:

- (1) The controller MANUAL/AUTO station shall be indexed to the AUTO position and the integral- and derivative-mode constants set to zero.
- (2) The proportional-mode constant shall be set to an initial setting of 8 percent. (This corresponds to 1.5 psig per degree F (10.3 kPa per 0.6 degree C) or 2.0 ma per degree F (4.4 degree C) proportional controller output change for a 100-degree F (55.6 degree C) transmitter span.) This causes the controller output signal to vary from live zero output to full output for an input signal change representing an 8-degree F change.
- (3) Controllers for other variables, such as relative humidity and static pressure, shall have their proportional-mode constants set initially in a similar manner for an achievable output range proportional to the transmitter span.

b. Step B:

- (1) The controller temperature setpoint shall be set at any achievable temperature. The controller output and transmitter input shall be observed.
- (2) If the transmitter input continuously oscillates above and below the setpoint without settling at a fixed value, or if such oscillation increases, the proportional-mode constant is too small.
- (3) If the proportional-mode constant is too small, increase it in steps until the transmitter input indicates stable control at any temperature, provided that the controller output is not at either extreme of the output range.
- (4) If the temperature control point slowly drifts toward or away from the controller setpoint, the proportional-mode constant is too large. Its setting shall be decreased in steps until oscillations occur as described in the preceding paragraphs, and then the setting shall be increased until stable control occurs.
- (5) A step change in controller setpoint shall be introduced. This should cause the controller to overshoot the setpoint slightly, with each subsequent overshoot peak value decreasing by a factor of  $2/3$  until stable control is achieved at, above, or below the setpoint.
- (6) Next, the integral-mode constant setting shall be increased in small steps, and setpoint changes shall be introduced until control point and controller setpoint coincide at stable control. This should happen consistently after a setpoint change within a short time, such as 5 to 10 minutes.

c. Step C:

- (1) Unless the HVAC process variable changes rapidly, the derivative-mode constant setting can remain at zero.



- (2) If derivative control is needed, the derivative-mode constant shall be gradually increased.
  - (3) Step changes in controller setpoint shall be introduced, and the derivative-mode constant setting adjusted until stable control is achieved.
- 11. Setting the Controller: After the controller manual-tuning procedure is complete, the controller shall be set at the setpoint as shown.
- B. Unit Heater and Cabinet Unit Heater: The "OFF/AUTO" switch shall be placed in the "OFF" position. Each space-thermostat temperature setting shall be turned up so that it makes contact and turns on the unit-heater fans. The unit-heater fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. It shall be ensured that the unit-heater fans start. Each space-thermostat temperature setting shall be turned down, and the unit-heater fans stop. The thermostats shall be set at their temperature setpoints as shown. The results of testing of one of each type of unit shall be logged.
- C. Single Building Hydronic-Heating with Hot Water Boiler: Steps for installation shall be as follows:
  - a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power and main air are available at the HVAC system control panel.
  - b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature- sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air temperature and system-supply temperature shall be checked.
  - c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all valves shall be verified visually. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15

psig (103kPa), and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma or 15 psig (103kPa). The signal levels that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

- (1) The outside-air temperature controller  
"MANUAL/AUTO" station shall be indexed to the "MANUAL" position and the two-point calibration sensing element-to-controller readout accuracy check for the outside-air temperature performed. The controller proportional band adjustment, the setpoint, the manual reset, and the maximum controller output shall be set to achieve the outside-air temperature schedule as shown.
- (2) A signal shall be applied to simulate that the outside-air temperature is above the setpoint as shown. It shall be verified that all Pumps and Boiler stop. A signal shall be applied to simulate that the outside-air temperature is below the setpoint as shown. It shall be verified that all Pumps start and Boiler operates.
- (3) The system's supply-temperature controller  
"MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of the sensing element-to-controller readout for the system-supply temperature performed. The controller shall be placed in the remote-setpoint mode. The remote setpoint for temperature schedule shall be set as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller setup and tuning procedures performed. The controller shall be set at a system-supply temperature setpoint within the schedule as shown and the mode-constant setpoints logged. Signals of 8 ma and 16 ma shall be sent to the remote setpoint from the outside-air temperature controller, to verify that the controller setpoint changes to the appropriate

values. The outside-air temperature controller's "MANUAL/AUTO" station shall be indexed to "AUTO."

- (4) An occupied-mode signal shall be applied. Each space-temperature controller "MANUAL/AUTO" station shall be indexed to "MANUAL." The calibration accuracy check of sensing element-to-controller readout for each space temperature performed, and the values logged. The controller shall be placed in the remote-setpoint mode. Setpoint shall be set for 70 degrees F (21.1 degrees C) at midrange, 55 degrees F (12.8 degrees C) at the low end, and 85 degrees F (29.4 degrees C) at the high end. The proper action of the temperature-setpoint device at the space-temperature sensing element and transmitter location shall be verified. Each controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller-tuning procedure performed. An unoccupied-mode signal shall be applied and it shall be verified that the controller setpoint changes to the unoccupied-mode setting. The temperature setpoint device shall be set to the space-temperature setpoint as shown.

D. Single Building Hydronic-Cooling with Chiller:

Steps for installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power and main air are available at the HVAC system control panel.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature- sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air temperature and system-supply temperature shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all valves shall be verified visually. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15 psig (103kPa), and it shall be verified that the

actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma or 15 psig (103kPa). The signal levels that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

- (1) The system's supply-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of the sensing element-to-controller readout for the system-supply temperature performed. The controller shall be placed in the remote-setpoint mode. The remote setpoint for temperature schedule shall be set as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller setup and tuning procedures performed. The controller shall be set at a system-supply temperature setpoint within the schedule as shown and the mode-constant setpoints logged.
- (4) An occupied-mode signal shall be applied. Each space-temperature controller "MANUAL/AUTO" station shall be indexed to "MANUAL." The calibration accuracy check of sensing element-to-controller readout for each space temperature performed, and the values logged. The controller shall be placed in the remote-setpoint mode. Setpoint shall be set for 70 degrees F (21.1 degrees C) at midrange, 55 degrees F (12.8 degrees C) at the low end, and 85 degrees F (29.4 degrees C) at the high end. The proper action of the temperature-setpoint device at the space-temperature sensing element and transmitter location shall be verified. Each controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller-tuning procedure performed. An unoccupied-mode signal shall be applied and it shall be verified that the controller setpoint changes to the unoccupied-mode setting. The temperature setpoint device shall be set to the space-temperature setpoint as shown.

E. Variable-Air-Volume Control System with Return Fan Steps for installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power and main air are available at the HVAC system control panel, and that the outside-air and relief-air dampers are closed, the return-air damper and return/relief-fan VFD is off, and the supply-fan VFD is off and cooling-coil valve are closed.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, mixed-air, and cooling-coil discharge-air temperatures shall be checked. The supply-air flow and return-air flow shall be read, using a digital indicating velometer, and the velometer and controller-display readings logged. The flows should read zero.
- c. Step 3 - Actuator Range Adjustments: A signal to the actuator shall be applied, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be visually verified. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15 psig (103 kPa), and verify that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma or 15 psig (103 kPa). The signal levels that move the controlled device to its extreme positions shall be logged.
- d. Step 4 - Control-System Commissioning:
  - (1) With the fans ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay pilot light turns on. The occupied-mode signal shall be applied, and it

shall be verified that the occupied-mode pilot light turns on and that Supply Fan and Return Fan start. It shall be verified that the outside-air damper and relief-air damper are closed, the return-air damper is open, and the cooling-coil valve is under control, by slightly changing the controller output. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and the outside-air, return-air and relief-air dampers come under control by changing the controller output.

- (2) The minimum-outside-air-mode signal shall be applied, and it shall be verified that the economizer pilot light is off. It shall be verified that the outside-air damper opens to its minimum position.
- (3) The starter switch of Return Fan shall be turned to the OFF position. With Supply Fan running, a high-static-pressure input signal shall be simulated at the device by pressure input to the sensing device. HVAC system shutdown shall be observed, it shall be verified that the high-static pilot light turns on, and contact output at EMCS terminals. The HVAC system shall be restarted by manual reset, and it shall be verified that the high-static pilot light turns off.
- (4) The supply-fan static-pressure controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and a two-point accuracy check of sensing element-to-controller readout performed. The controller shall be placed in the local setpoint mode. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. The controller shall be set at the specified static-pressure setpoint, and the mode-constant setpoints logged.
- (5) Each VAV terminal unit controller's minimum-flow and maximum-flow setpoints shall be set at the same setting. This will prevent the VAV-box damper from modulating under space-temperature control and will achieve a constant supply-duct-system pressure drop. The return-fan inlet vane shall be placed under control, and the

starter switch shall be turned to the "AUTO" position so that the fan starts. The "MANUAL/AUTO" station of the return-fan air-volume controller shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of sensing element-to-controller readout performed. The controller shall be placed in the remote-setpoint mode. Using the supply-duct static-pressure controller's "MANUAL" function, operate the supply-fan inlet vane to change the supply-fan flow, and the controller ratio and bias settings shall be set to control cfm at 4-ma input and cfm at 20-ma input. The supply-fan flow shall be changed to verify that the return-flow setpoint tracks the supply-fan flow with the proper flow difference. A 12-ma signal shall be sent for tuning at setpoint midrange. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller tuning procedure shall be performed. A 4-ma, 12-ma and 20-ma signals shall be sent to the remote setpoint input, and it shall be verified whether the return fan goes from minimum-delivery setpoint to midrange delivery setpoint, and then to maximum-delivery setpoint. The supply-duct static-pressure controller shall be placed in "AUTO."

- (6) The mixed-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. The controller output shall be changed to open the outside-air damper slightly. The two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and mixed-air temperatures shall be performed. The temperature-controller "MANUAL/AUTO" switch shall be indexed to the "AUTO" position. The economizer-mode input signal shall be applied, and it shall be verified that the economizer pilot light turns on. The controller-tuning procedure shall be performed. The controller shall be placed in the local setpoint mode, and set at the temperature setpoint as shown.
- (7) The cooling-coil temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check of sensing element-to-controller readout performed. The controller shall be placed

in the remote-setpoint mode. The remote setpoint shall be set for plus 5-degree F (2.8 degree C) change from setpoint at 20-ma input, and minus 5-degree F (2.8 degree C) change from setpoint at 4-ma input. A 12-ma signal shall be sent to the remote setpoint for tuning at midrange. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. Signals of 8 ma and 16 ma shall be sent to the remote setpoint and it shall be verified that the controller setpoint changes to the appropriate values. The controller shall be placed in the local setpoint mode and set at the temperature setpoint as shown.

- (8) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.
- (9) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated, at the device. It shall be verified that the filter pilot light turns on, and contact output at EMCS terminals shall be verified. The differential-pressure switch shall be set at the setpoint as shown.
- (10) With the HVAC system running, a low-temperature-protection trip input signal shall be simulated, at the device. The HVAC system shutdown, and contact output at EMCS terminals shall be verified. It shall be verified that the low-temperature pilot light turns on. The thermostat shall be set at the specified setting. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.
- (11) With the HVAC system running, a smoke-detector trip input signal shall be simulated, at each device. Control-device actions and interlock functions as described in the Sequence of Operation shall be verified. Simulation shall be performed without



false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and the smoke-detector pilot light turns on. Contact output at EMCS terminals shall be verified. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and observe that the pilot light turns off.

(12) For each VAV terminal unit, velocity setpoints shall be set for minimum and maximum flow, and temperature setpoints for the heating/cooling dead band. The actions of the controller, the operation of the damper, and the operation of heating shall be verified. It shall be verified that space temperature is maintained.

F. Single-Zone with Hydronic Heating and Cooling Coils; Return Fan Steps for installation shall be as follows:

- a. Step 1 - System Inspection: The HVAC system shall be verified in its shutdown condition. The system shall be checked to see that power and main air are available at the HVAC system control panel, that the outside-air damper, relief-air damper, and cooling coil valve are closed, and that the return-air damper is open.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, and space temperatures shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be visually verified. The signal shall be varied from live zero of 4 ma or 3 psig (21 kPa) to 20 ma or 15 psig (103 kPa), and the actuators travel from zero stroke to full stroke within the signal range shall be verified. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other. Example: NC actuators are closed at 4 ma or 3 psig (21 kPa) and are open at 20 ma or 15 psig (103 kPa). The signal levels

that move the controlled device to its extreme positions shall be logged.

d. Step 4 - Control-System Commissioning:

- (1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that Supply Fan and Return Fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating-coil and cooling-coil valves are under control, by slightly changing the controller outputs. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control by changing the controller output.
- (2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and the economizer pilot light is off.
- (3) The space-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check for sensing element-to-controller readout performed. The controller shall be placed in the remote-setpoint mode. Setpoint shall be set for 70 degrees F (21.1 degrees C) at midpoint, 55 degrees F (12.8 degrees C) at the low end, and 85 degrees F (29.4 degrees C) at the high end. Proper operation of the temperature setpoint device at the space-temperature sensing element and transmitter location shall be verified. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. The temperature setpoint device shall be set to the space temperature setpoint as shown.
- (4) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and

the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(5) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated, at the device. It shall be verified that the filter pilot light turns on, and contact output at EMCS terminals shall be verified. The differential-pressure switch shall be set at the setpoint as shown.

(6) With the HVAC system running, a low-temperature-protection thermostat trip input signal shall be simulated, at the device. HVAC system shutdown shall be verified, the low-temperature pilot light turns on, and verify contact output at EMCS terminals shall be verified. The thermostat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.

(7) With the HVAC system running, a smoke-detector trip input signal at each detector shall be simulated, and control-device actions and interlock functions as described in the Sequence of Operation shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at EMCS terminals shall be verified. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.

### 3.5 TESTING, COMMISSIONING, AND BALANCING

- A. Site Testing: The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing, calibration, adjusting and commissioning. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. HVAC control panels shall be pretested

off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. The Contractor shall obtain written Government approval of the specific site-testing procedures prior to any test. Written notification of any planned site-testing, commissioning or tuning shall be given to the Government at least 14 calendar days prior to any test.

- B. Control System Calibration, Adjustments, and Commissioning: All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Mechanical control devices shall be adjusted to operate as specified. Control system commissioning shall be performed for each HVAC system.
- C. Performance Verification Test: The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written certification of successful completion of Contractor site testing as specified.
- D. Coordination with HVAC System Balancing: The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued. Commissioning, except for tuning of controllers, may be performed prior to or simultaneous with HVAC system balancing.
- E. Posted Instructions: Instructions on 8-1/2-by-11-inch (216 mm by 279 mm) sheets and half-size plastic laminated drawings for each system, showing the final installed conditions, shall be placed in each HVAC control panel. The posted instructions shall include the control sequence, control schematic, ladder diagram, wiring diagram, valve schedules, damper schedules, panel arrangement drawings, commissioning procedures, controller configuration check sheet with final configuration record, preventive

maintenance instructions and single-loop controller operators manual.

### 3.6 TRAINING

- A. Training-Course Requirements: A training course shall be conducted for operating staff members designated by the Contracting Officer. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. The Contractor shall be responsible for furnishing all audiovisual equipment and sets of all other training materials and supplies. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. The Contractor shall submit an outline for the course, with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the start of the training.
- B. Training-Course Content: For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

END OF SECTION



SECTION 15990

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Measurement of final operating condition of HVAC systems.
- D. Sound measurement of equipment operating conditions.
- E. Vibration measurement of equipment operating conditions.

1.2 RELATED SECTIONS

- A. Inspection and testing allowances.
- B. Testing laboratory services: Employment of testing agency and payment for services.
- C. Starting of Systems.

1.3 ALLOWANCES

- A. Cash Allowance: Include under provisions of Divisions 0 and 1. Refer to Inspection and Testing Allowances and Administrative Provisions for the Cash Allowance Sum applicable to this section.
- B. Allowance includes testing, adjusting, and balancing of mechanical systems. Work is included in this section and is part of the Contract Sum/Price.

1.4 CODES AND STANDARDS  
(Latest Edition or Revision)

- A. AABC MN-1 - National Standards for Total System Balance.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. ANSI S1.4 - Sound Level Meters
- D. ANSI S1.11 - Octave-Band and Fractional - Octave Band Analog and Digital Filters

- E. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
  - F. CTI ATC-105 - Acceptance Test Code for Water-Cooling Towers.
  - G. NEBB-01 - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
  - H. NFPA90A - Installation of Air conditioning and Ventilating Systems.
  - I. SMACNA-07 - HVAC Systems Testing, Adjusting, and Balancing.
- 1.5 SUBMITTAL: Government approval is required for submittal with a (GA) designation; submittal having an (FIO) designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:
- A. Agency: Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
  - B. Field Reports: Submit under provisions of Section 15010.
    - 1. Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - C. Data Reports: Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
  - D. Draft Reports: Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals. Submit 6 complete sets of draft report.
  - E. Final Reports: Submit final reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs for each appropriate section, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. Provide schematic systems diagrams as required. Submit 6 complete sets of final report.



1. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

F. Test Reports: Indicate data on AABC National Standards for Total System Balance forms NEBB forms.

G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

#### 1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 15010.

B. Record actual locations of flow measuring stations balancing valves and rough setting.

#### 1.7 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance ASHRAE 111 NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Maintain one copy of each document on site.

#### 1.8 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor. The lead balancing technician's qualification data shall include past experience on at least five similar projects.

#### 1.9 PRE-BALANCING CONFERENCE

A. One week prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system

operation and readiness for testing, adjusting, and balancing.

#### 1.10 SEQUENCING

- A. Sequence work under the provisions of Divisions 0 and 1.
- B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. Systems shall be fully operational prior to beginning procedures.
- C. Test, adjust, and balance the air systems before hydronic and refrigerant systems.

#### 1.11 SCHEDULING

- A. Schedule work under the provisions of Divisions 0 and 1.
- B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg F (2.8 deg C) wet-bulb temperature of maximum summer design condition, and within 10 deg F (5.6 deg C) dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

### PART 2 PRODUCTS

(Not Applicable)

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Prefilters are clean and in place.

5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

### 3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

### 3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent and minus 5 percent of design for supply systems and plus 10 percent and minus 5 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus 10 percent and minus 5 percent of design.

- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

### 3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Following final acceptance of certified reports by the Contracting Officer, permanently mark settings of all valves, splitters, dampers, and other adjustment devices allowing settings to be restored if disturbed any time. Set and lock all memory stops.
- C. The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.
- D. After adjustment, take measurements to verify balance has not been disrupted, or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- G. Check and adjust systems approximately six months after final acceptance and submit report.

### 3.5 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

- A. Before operating the system, perform the following steps.
  - 1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
  - 2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

### 3.6 AIR SYSTEM BALANCING PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air

motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes where required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.
- M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

### 3.7 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

- A. Before operating the system perform the following steps:
  - 1. Open valves to full open position. Close coil bypass valves.
  - 2. Remove and clean all strainers.
  - 3. Examine hydronic systems and determine if water has been treated and cleaned.
  - 4. Check pump rotation.
  - 5. Clean and set automatic fill valves for required system pressure.

6. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
7. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
8. Set temperature controls so all coils are calling for full flow.
9. Check operation of automatic bypass valves.
10. Check and set operating temperatures of chillers to design requirements.
11. Lubricate all motors and bearings.

### 3.8 HYDRONIC SYSTEM BALANCING PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated [Venturi tubes, orifices, or other metered] fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

### 3.9 SPECIFIC SYSTEMS

- A. Where specific systems require special or additional procedures for testing and balancing, such procedures shall be in accordance with the standard selected in paragraph GENERAL REQUIREMENTS. If a system has diversity, only the required quantity of wide-open terminals shall be used to meet the design water flow.
  - 1. Primary-Secondary: Primary-secondary systems shall be treated as separate systems. Primary systems shall be balanced first with the secondary systems running. Secondary systems shall then be balanced.
  - 2. Summer-Winter: Summer-winter systems shall be balanced in the summer mode of operation. Following completion of the summer-mode balancing, equipment used for winter operation shall be balanced.
  - 3. Four-Pipe System: Four-pipe system shall be considered as two two-pipe systems, and balanced separately.

### 3.10 SOUND LEVEL TESTING

- A. After the systems are properly tested, adjusted and balanced, sound levels shall be checked in accordance with the applicable provisions of AABC MN-1. Octave-band analysis and noise-criteria curve data shall be recorded on forms shown in AABC MN-1. All occupied areas including offices, corridors, assembly and meeting rooms shall be verified to be within the sound levels shown or as specified. Any areas not meeting the requirements of AABC MN-1 or the specifications or drawings shall be clearly indicated in the form and an explanation of all discrepancies shall be provided in test report.

### 3.11 VEHICLE EXHAUST SYSTEMS

- A. All tests and measurements shall be performed in accordance with AABC MN-1 or NEBB-01 for similar exhaust system components. Air flow rates at each exhaust outlet shall be equal quantities, unless otherwise shown, with the system exhaust fan providing the total air flow rate shown.

### 3.12 PAINT SPRAY BOOTHS

- A. All tests and measurements shall be performed in accordance with AABC MN-1 or NEBB-01 for similar supply and exhaust system components. Filters, or devices used to simulate filter-flow characteristics, shall have a pressure drop of



50 percent of the loaded condition, at the design flow rate. air flows shall be set to 10 percent above the design air flow rate. Air flow shall be verified to be uniform across the supply and exhaust filter sections.

### 3.13 CONTROL SYSTEMS

- A. Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

### 3.14 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing shall include, and shall not be limited to the following:

1. Fire Pumps
2. Sprinkler Air Compressor
3. Electric Water Coolers
4. Plumbing Pumps
5. HVAC Pumps
6. Cast Iron Boilers
7. Air cooled water chillers
8. Fuel Fired Unit Heaters
9. Air Coils
10. Terminal Heat Transfer Units
11. Air Handling Units
12. Fans
13. Air Filters
14. Air terminal units
15. Air Inlets and Outlets
16. Vehicle Exhaust Systems

## 17. Infrared Radiant Heating Systems

### B. Report Forms

#### 1. Title Page:

- a) Name of Testing, Adjusting, and Balancing Agency
- b) Address of Testing, Adjusting, and Balancing Agency
- c) Telephone number of Testing, Adjusting, and Balancing Agency
- d) Project name
- e) Project location
- f) Project Architect
- g) Project Engineer
- h) Project Contractor
- i) Project altitude
- j) Report date

#### 2. Summary Comments:

- a) Design versus final performance
- b) Notable characteristics of system
- c) Description of systems operation sequence
- d) Summary of outdoor and exhaust flows to indicate amount of building pressurization
- e) Nomenclature used throughout report
- f) Test conditions

#### 3. Instrument List:

- a) Instrument
- b) Manufacturer
- c) Model number

- d) Serial number
  - e) Range
  - f) Calibration date
4. Electric Motors:
- a) Manufacturer
  - b) Model/Frame
  - c) HP/BHP
  - d) Phase, voltage, amperage; nameplate, actual, no load
  - e) RPM
  - f) Service factor
  - g) Starter size, rating, heater elements
  - h) Sheave Make/Size/Bore
5. V-Belt Drive:
- a) Identification/location
  - b) Required driven RPM
  - c) Driven sheave, diameter and RPM
  - d) Belt, size and quantity
  - e) Motor sheave diameter and RPM
  - f) Center to center distance, maximum, minimum, and actual
6. Pump Data:
- a) Identification/number
  - b) Manufacturer
  - c) Size/model
  - d) Impeller

- e) Service
- f) Design flow rate, pressure drop, BHP
- g) Actual flow rate, pressure drop, BHP
- h) Discharge pressure
- i) Suction pressure
- j) Total operating head pressure
- k) Shut off, discharge and suction pressures
- l) Shut off, total head pressure

7. Combustion Test:

- a) Boiler manufacturer
- b) Model number
- c) Serial number
- d) Firing rate
- e) Overfire draft
- f) Gas meter timing dial size
- g) Gas meter time per revolution
- h) Gas pressure at meter outlet
- i) Gas flow rate
- j) Heat input
- k) Burner manifold gas pressure
- l) Percent carbon monoxide (CO)
- m) Percent carbon dioxide (CO<sub>2</sub>)
- n) Percent oxygen (O<sub>2</sub>)
- o) Percent excess air
- p) Flue gas temperature at outlet

- q) Ambient temperature
- r) Net stack temperature
- s) Percent stack loss
- t) Percent combustion efficiency
- u) Heat output

8. Heating Coil Data:

- a) Identification/number
- b) Manufacturer
- c) Capacity
- d) Model number
- e) Serial number
- f) Evaporator entering water temperature, design and actual
- g) Evaporator leaving water temperature, design and actual
- h) Evaporator pressure drop, design and actual
- i) Evaporator water flow rate, design and actual

9. Cooling Coil Data:

- a) Identification/number
- b) Location
- c) Service
- d) Manufacturer
- e) Air flow, design and actual
- f) Entering air DB temperature, design and actual
- g) Entering air WB temperature, design and actual
- h) Leaving air DB temperature, design and actual

- i) Leaving air WB temperature, design and actual
- j) Water flow, design and actual
- k) Water pressure drop, design and actual
- l) Entering water temperature, design and actual
- m) Leaving water temperature, design and actual
- n) Saturated suction temperature, design and actual
- o) Air pressure drop, design and actual

10. Air Moving Equipment

- a) Location
- b) Manufacturer
- c) Model number
- d) Serial number
- e) Arrangement/Class/Discharge
- f) Air flow, specified and actual
- g) Return air flow, specified and actual
- h) Outside air flow, specified and actual
- i) Total static pressure (total external), specified and actual
- j) Inlet pressure
- k) Discharge pressure
- l) Sheave Make/Size/Bore
- m) Number of Belts/Make/Size
- n) Fan RPM

11 Return Air/Outside Air Data:

- a) Identification/location

- b) Design air flow
- c) Actual air flow
- d) Design return air flow
- e) Actual return air flow
- f) Design outside air flow
- g) Actual outside air flow
- h) Return air temperature
- i) Outside air temperature
- j) Required mixed air temperature
- k) Actual mixed air temperature
- l) Design outside/return air ratio
- m) Actual outside/return air ratio

12 Exhaust Fan Data:

- a) Location
- b) Manufacturer
- c) Model number
- d) Serial number
- e) Air flow, specified and actual
- f) Total static pressure (total external), specified and actual
- g) Inlet pressure
- h) Discharge pressure
- i) Sheave Make/Size/Bore
- j) Number of Belts/Make/Size
- k) Fan RPM

13 Duct Traverse:

- a) System zone/branch
- b) Duct size
- c) Area
- d) Design velocity
- e) Design air flow
- f) Test velocity
- g) Test air flow
- h) Duct static pressure
- i) Air temperature
- j) Air correction factor

14 Duct Leak Test:

- a) Description of ductwork under test
- b) Duct design operating pressure
- c) Duct design test static pressure
- d) Duct capacity, air flow
- e) Maximum allowable leakage duct capacity times leak factor
- f) Test apparatus
  - 1. Blower
  - 2. Orifice, tube size
  - 3. Orifice size
  - 4. Calibrated
- g) Test static pressure
- h) Test orifice differential pressure
- i) Leakage



15 Air Monitoring Station Data:

- a) Identification/location
- b) System
- c) Size
- d) Area
- e) Design velocity
- f) Design air flow
- g) Test velocity
- h) Test air flow

16 Flow Measuring Station:

- a) Identification/number
- b) Location
- c) Size
- d) Manufacturer
- e) Model number
- f) Serial number
- g) Design Flow rate
- h) Design pressure drop
- i) Actual/final pressure drop
- j) Actual/final flow rate
- k) Station calibrated setting

17 Air Distribution Test Sheet:

- a) Air terminal number
- b) Room number/location
- c) Terminal type

- d) Terminal size
  - e) Area factor
  - f) Design velocity
  - g) Design air flow
  - h) Test (final) velocity
  - i) Test (final) air flow
  - j) Percent of design air flow
- 18 Sound Level Report:
- a) Location
  - b) Octave bands - equipment off
  - c) Octave bands - equipment on
- 19 Vibration Test:
- a) Location of points:
    - 1. Fan bearing, drive end
    - 2. Fan bearing, opposite end
    - 3. Motor bearing, center (if applicable)
    - 4. Motor bearing, drive end
    - 5. Motor bearing, opposite end
    - 6. Casing (bottom or top)
    - 7. Casing (side)
    - 8. Duct after flexible connection (discharge)
    - 9. Duct after flexible connection (suction)
  - b) Test readings:
    - 1. Horizontal, velocity and displacement
    - 2. Vertical, velocity and displacement

3. Axial, velocity and displacement

- c) Normally acceptable readings, velocity and acceleration
- d) Unusual conditions at time of test
- e) Vibration source (if non-complying)

END OF SECTION



SECTION 16010

GENERAL PROVISIONS, ELECTRICAL

PART

1 GENERAL

1.1 SECTION INCLUDES

- A. Basic electrical requirements that are applicable to all Division 16 Sections in addition to Division 0 - Contract Requirements and Division 1 - General Requirements.

1.2 RELATED SECTIONS

- A. DIVISION 0 - CONTRACT REQUIREMENTS.
- B. DIVISION 1 - GENERAL REQUIREMENTS.
- C. DIVISION 2 - SITE WORK.
- D. DIVISION 3 - CONCRETE
- E. DIVISION 7 - THERMAL AND MOISTURE PROTECTION
- F. DIVISION 8 - DOORS AND WINDOWS.
- G. DIVISION 9 - FINISHES.
- H. DIVISION 10 - SPECIALTIES.
- I. DIVISION 11 - EQUIPMENT
- J. DIVISION 15 - MECHANICAL

1.3 CONTRACTOR'S RESPONSIBILITY:

- A. Refer to Sections in division 0 and 1.

1.4 CODES AND STANDARDS

- A. All work shall be manufactured, installed and labeled in accordance with the applicable provisions of the latest editions of the following codes and standards, including Addendums and modifications made by local authorities.
  - 1. NFC - National Fire Code
  - 2. NEC - National Electrical Code

3. SBC - Standard Building Code
4. SFPC - Standard Fire Prevention Code
5. UBC - Uniform Building Code
6. BOCA Basic National Building Code - Building Officials and Code Administrators International, Inc.
7. NESC - National Electrical Safety Code
8. NECA - National Electrical Contractors Association
9. UL - Underwriters Laboratories
10. NEMA - National Electrical Manufacturers Association
11. OSHA - Occupational Safety and Health Act
12. Local codes and ordinances
13. IEEE - Institute of Electrical & Electronic Engineers
14. Equipment manufacturer's Published Instructions
15. Other applicable codes and standards specified in other sections hereinafter.

B. Where the contract documents exceed the code or standard requirements, the Contract Documents shall take precedence.

C. All electrical materials shall be listed by Underwriters' Laboratory (UL), and shall be so labeled where UL labeling is customary.

#### 1.5 GOVERNMENT FURNISHED EQUIPMENT AND INSTALLATION

A. Refer to Sections in division 0 and 1.

B. The Government will furnish and install all telephone system equipment and outlets. The contractor shall provide wiring, outlet boxes, conduits, backboards, etc. as specified.

#### 1.6 WORK SEQUENCE

A. Refer to Sections in division 0 and 1.

#### 1.7 FUTURE WORK

A. Refer to Sections in division 0 and 1.

## 1.8 ALLOWANCES

- A. Refer to Sections in division 0 and 1.

## 1.9 UNIT PRICES

## 1.10 ALTERNATES

- A. Refer to Sections in division 0 and 1.

## 1.11 COORDINATION DRAWINGS

- A. Refer to Sections in division 0 and 1.

## 1.12 ACCURACY OF DATA AND DRAWINGS:

- A. Drawings and Data: Electrical drawings are generally diagrammatic, and where not dimensioned or detailed, indicate approximate locations and general arrangements of electrical work. Exact conduit routing, offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation. Provide all inserts, anchors, supports and sleeves as required.
- B. The indicated branch circuit conduit routings are intended to show the required circuitry from panelboards to outlets, fixtures and other devices. However, if necessitated by job conditions, deviations from the indicated routings may be made, provided that regardless of the actual installed arrangement of the conduits: each outlet marked with the same circuit number is connected to the same corresponding numbered circuit; outlets are switched and controlled as indicated; and no home run is brought into any switch box unless otherwise indicated.
- C. Major equipment items such as panelboards, transformers, switchboards, motor control centers, control panels, etc. are drawn to scale using nominal dimensions based on information of one of the major manufacturer's of the item. The Contractor shall inform prospective equipment suppliers of any space limitations associated with the locations of the equipment and verify that their equipment will or will not fit in the space indicated on the drawings. Proper clearances in front of and around equipment and required for working and cooling shall be maintained as indicated or required by applicable codes or equipment manufacturer's requirements. If there are any conflicts, the Contractor

shall notify the Resident Officer In Charge before the project Bid Date.

- D. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND STRUCTURAL DRAWINGS.
- E. Equipment NOT furnished by Electrical Section but requiring electrical connections: from other sections and others furnishing this equipment, determine exact electrical connection requirements therefore. Locations and arrangements of electrical connections indicated for this equipment are APPROXIMATE ONLY. Refer to Section 16180.

1.13 SUBMITTALS: Submittals shall be provided to the Engineer as described in Sections in division 0 and 1.

- A. All Devices: Submittals shall be made for all wire, conduit, equipment and devices described in this specification. See appropriate section for detailed information to be included in the submittal.

1.14 PROCUREMENT OF ELECTRICAL DEVICES AND EQUIPMENT:

- A. Refer to Sections in division 0 and 1.

1.15 GROUNDING:

- A. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes. Refer to Section 16170.

1.16 TYPE OF SYSTEM, WIRING METHOD:

- A. Electrical system characteristics: Voltages and amperages shall be as indicated.
- B. Regardless of voltage or use, install wiring in conduits and metal or other enclosures, unless otherwise indicated or otherwise specified.

1.17 TEMPORARY CONSTRUCTION POWER:

- A. The Contractor shall provide temporary power service equipment, lighting fixtures, devices, and wiring as required for the project. Refer to Sections in division 0 and 1.



## PART 2 PRODUCTS

### 2.1 HOUSEKEEPING PADS

- A. Provide 4" high concrete pads for all floor mounted electrical equipment such as transformers, switchgear, transfer switches, large distribution panels, etc. The pad dimensions shall be approximately 2 inches larger than the equipment in the width and depth dimensions. Bevel the edges of the pad to reduce chipping. Refer to Section 03300 for concrete specifications.

## PART 3 EXECUTION

### 3.1 EQUIPMENT INSTALLATION:

- A. Copies of applicable equipment manufacturer's installation drawings and instructions shall be kept on site.

### 3.2 TESTS, INSPECTIONS, ADJUSTMENTS AND CLEANUP:

- A. Perform work in accordance with Sections in division 0 and 1.
- B. Furnish suitable testing equipment, give the Resident Officer in Charge and all applicable authorities ample advance notice of all proposed tests and readiness of work for observations, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary observations have been made and all required tests have been approved by the Engineer and all applicable authorities.
- C. Put entire electrical system in operation, test all equipment, remedy all defects and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated and as approved.
- D. Clean all electrical work thoroughly. Remove foreign matter which has accumulated in all fixtures, equipment, and enclosures. Clean all fixture glassware and reflectors and clean and polish all other surfaces that are not to be painted so that they present a new and acceptable appearance. Manufacturer's cleaning instructions shall be followed if applicable. Any finished surfaces that are scratched or marred shall be touched up or refinished with materials approved by the manufacturer.

### 3.3 FIELD PAINTING:

- A. Refer to Section 09900.

### 3.4 PROTECTION AND CLEANING:

- A. Refer to Sections in division 0 and 1.
- B. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

### 3.5 OPERATING INSTRUCTIONS:

- A. Furnish the services of a competent person (or persons) to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for each system installed in accordance with Sections in division 0 and 1.
- B. Furnish and deliver to the User operation and maintenance manuals for all equipment installed under this contract in accordance with Sections in division 0 and 1.

### 3.6 AS-BUILT DRAWINGS:

- A. The Contractor shall provide as-built drawings in accordance with Sections in division 0 and 1.

### 3.7 GUARANTEE:

- A. The Contractor shall guarantee all work in accordance with Sections in division 0 and 1.

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*****
*
* E/CALC DISTRIBUTION SYSTEM REPORT - Project: Fort Lawton
*
*                               for
*
*               Jones Mah Gaskill Rhodes, Inc. - Memphis, TN
*
*****
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Mon Oct 19 16:44:18 1998

Data drive:\path C:\981170\

Wire resistance and reactance values are from 1990 NEC(r) Chapter 9 Table 9.

Voltage drop computations use ohmic values.

NEC(r) resistance is adjusted to Centigrade value shown on "Phase wires" line.

Fault current computations use per unit values - base = 10,000.

NEC(r) resistance is adjusted to Centigrade value shown on "Ambient temp" line.

Utility available fault current = 20900 RMS symmetrical amps      X/R = 6.0  
Utility line-to-neutral voltage = 277

Service entrance equipment: MDP                      480Y/277V 3P 4W

Downstream equipment = 17

MHA	LHA	RLA	LHA1	LHA2	LHA3	LHA4	LHA5	LHA6	RLA1	RLA2
RLA3	RLA4	RLA5	RLA6	RLA7	RLA8					

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MDP      480Y/277V 3P 4W Power panel          - ckt br - Feeder UTILITY

Load Load Load      Voltage at      Voltage drop %      Fault contrib - RMS Sym
      FLA  PF%      equipment      Cond Trans Total      Utility Motors  Total
NL      -    -      479.8Y/277.0      -    -    -      18926      -      18926
Ht     929  89.0    477.5Y/275.7    0.48  -    0.48    18926    1834    20760
A/C     913  88.4    477.5Y/275.7    0.48  -    0.48    18926    1834    20760

Feeder
OCP Amps      1200      (minimum = 1008)
Type-Loc-Len  THW Copper - OH 100ft
Conduit(s)    (4) 3" EMT
Phase wires   3#350KCM (75C - 100% load)
Neutral wire  #350KCM
Ground wire   -
Isolated Gnd  -
Ambient temp  30C
```

-----									
MHA	480Y/277V 3P 4W Power panel					- ckt br - Feeder MDP			
Load	Load	Load	Voltage at	Voltage drop %			Fault contrib -		RMS Sym
	FLA	PF%	equipment	Cond	Trans	Total	Utility	Motors	Total
NL	-	-	479.8Y/277.0	-	-	-	14999	-	14999
Ht	189	87.5	475.9Y/274.8	0.81	-	0.81	14999	1388	16387
A/C	174	85.0	476.1Y/274.8	0.78	-	0.78	14999	1388	16387
Feeder									
OCP Amps	225		(minimum = 225)						
Type-Loc-Len	THW Copper		- OH 60ft						
Conduit(s)	(1) 2-1/2"		EMT						
Phase wires	3#4/0		(75C - 100% load)						
Neutral wire	#4/0								
Ground wire	#4		(NEC(r) 250-95)						
Isolated Gnd	-								
Ambient temp	30C								
-----									
LHA	480Y/277V 3P 4W Power panel					- ckt br - Feeder MDP			
Load	Load	Load	Voltage at	Voltage drop %			Fault contrib -		RMS Sym
	FLA	PF%	equipment	Cond	Trans	Total	Utility	Motors	Total
NL	-	-	479.8Y/277.0	-	-	-	18162	-	18162
Ht	151	95.0	477.3Y/275.5	0.52	-	0.52	18162	1684	19846
A/C	151	95.0	477.3Y/275.6	0.52	-	0.52	18162	1684	19846
Feeder									
OCP Amps	225		(minimum = 200)						
Type-Loc-Len	THW Copper		- OH 10ft						
Conduit(s)	(1) 2-1/2"		EMT						
Phase wires	3#4/0		(75C - 100% load)						
Neutral wire	#4/0								
Ground wire	#4		(NEC(r) 250-95)						
Isolated Gnd	-								
Ambient temp	30C								
-----									
RLA	208Y/120V 3P 4W Power panel					- ckt br - Feeder MDP			
Transformer KVA=	300	Z%= 3.7	X/R= 1.7	Taps= 2.5% FCBN					
Load	Load	Load	Voltage at	Voltage drop %			Fault contrib -		RMS Sym
	FLA	PF%	equipment	Cond	Trans	Total	Utility	Motors	Total
NL	-	-	213.3Y/123.1	-	-2.56	-	14881	-	14881
Ht	691	99.6	208.3Y/120.2	0.64	-0.81	-0.17	14881	454	15335
A/C	691	99.6	208.3Y/120.2	0.64	-0.81	-0.17	14881	454	15335
Secondary									
OCP Amps	900		(minimum = 694)			Primary			
Type-Loc-Len	THW Copper		- OH 5ft			THW Copper - OH 40ft			
Conduit(s)	(3) 3-1/2"		EMT			(2) 2-1/2" EMT			
Phase wires	3#500KCM		(75C - increased)			3#250KCM (75C - 100% load)			
Neutral wire	#500KCM					-			
Ground wire	#3/0		(NEC(r) 250-94)			#2 (NEC(r) 250-95)			
Isolated Gnd	-					-			
Ambient temp	30C								
30C									

LHA1 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %	Cond	Trans	Total	Fault contrib - Utility	RMS Motors	Sym Total
NL	-	-	479.8Y/277.0	-	-	-	-	5897	-	5897
Ht	28	95.0	475.2Y/274.3	0.97	-	0.97	0.97	5897	118	6015
A/C	28	95.0	475.2Y/274.3	0.96	-	0.96	0.96	5897	118	6015

Feeder

OCP Amps	100	(minimum = 35)
Type-Loc-Len	THW Copper	- OH 170ft
Conduit(s)	(1) 1-1/4"	EMT
Phase wires	3#3	(75C - 100% load)
Neutral wire	#3	
Ground wire	#8	(NEC(r) 250-95)
Isolated Gnd	-	

Ambient temp 30C

LHA2 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %	Cond	Trans	Total	Fault contrib - Utility	RMS Motors	Sym Total
NL	-	-	479.8Y/277.0	-	-	-	-	5111	-	5111
Ht	13	95.0	476.1Y/274.9	0.78	-	0.78	0.78	5111	74	5185
A/C	13	95.0	476.1Y/274.9	0.77	-	0.77	0.77	5111	74	5185

Feeder

OCP Amps	60	(minimum = 20)
Type-Loc-Len	THW Copper	- OH 110ft
Conduit(s)	(1) 1-1/4"	EMT
Phase wires	3#6	(75C - 100% load)
Neutral wire	#6	
Ground wire	#10	(NEC(r) 250-95)
Isolated Gnd	-	

Ambient temp 30C

LHA3 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %	Cond	Trans	Total	Fault contrib - Utility	RMS Motors	Sym Total
NL	-	-	479.8Y/277.0	-	-	-	-	7579	-	7579
Ht	28	95.0	475.8Y/274.7	0.84	-	0.84	0.84	7579	205	7784
A/C	28	95.0	475.8Y/274.7	0.84	-	0.84	0.84	7579	205	7784

Feeder

OCP Amps	90	(minimum = 35)
Type-Loc-Len	THW Copper	- OH 100ft
Conduit(s)	(1) 1-1/4"	EMT
Phase wires	3#4	(75C - reduced 1)
Neutral wire	#4	
Ground wire	#8	(NEC(r) 250-95)
Isolated Gnd	-	

Ambient temp 30C



LHA4 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	479.8Y/277.0	-	-	-	9124	-	9124
Ht	21	95.0	476.5Y/275.1	0.70	-	0.70	9124	320	9444
A/C	21	95.0	476.5Y/275.1	0.70	-	0.70	9124	320	9444

Feeder  
OCP Amps 90 (minimum = 30)  
Type-Loc-Len THW Copper - OH 75ft  
Conduit(s) (1) 1-1/4" EMT  
Phase wires 3#4 (75C - reduced 1)  
Neutral wire #4  
Ground wire #8 (NEC(r) 250-95)  
Isolated Gnd -

Ambient temp 30C

LHA5 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	479.8Y/277.0	-	-	-	9745	-	9745
Ht	46	95.0	475.7Y/274.6	0.87	-	0.87	9745	385	10130
A/C	46	95.0	475.7Y/274.6	0.86	-	0.86	9745	385	10130

Feeder  
OCP Amps 100 (minimum = 60)  
Type-Loc-Len THW Copper - OH 80ft  
Conduit(s) (1) 1-1/4" EMT  
Phase wires 3#3 (75C - 100% load)  
Neutral wire #3  
Ground wire #8 (NEC(r) 250-95)  
Isolated Gnd -

Ambient temp 30C

LHA6 480Y/277V 3P 4W Lighting panel

- Feeder LHA

Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	479.8Y/277.0	-	-	-	11919	-	11919
Ht	15	95.0	476.9Y/275.3	0.60	-	0.60	11919	599	12518
A/C	15	95.0	477.0Y/275.3	0.60	-	0.60	11919	599	12518

Feeder  
OCP Amps 60 (minimum = 20)  
Type-Loc-Len THW Copper - OH 30ft  
Conduit(s) (1) 1-1/4" EMT  
Phase wires 3#6 (75C - 100% load)  
Neutral wire #6  
Ground wire #10 (NEC(r) 250-95)  
Isolated Gnd -

Ambient temp 30C

RLA1 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	213.3Y/123.1	-	-2.56	-	4321	-	4321
Ht	66	95.0	205.6Y/118.7	1.94	-0.81	1.13	4321	30	4351
A/C	66	95.0	205.6Y/118.7	1.93	-0.81	1.13	4321	30	4351

Feeder  
 OCP Amps 150 (minimum = 70)  
 Type-Loc-Len THW Copper - OH 180ft  
 Conduit(s) (1) 2" EMT  
 Phase wires 3#1/0 (75C - 100% load)  
 Neutral wire #1/0  
 Ground wire #6 (NEC(r) 250-95)  
 Isolated Gnd -

Ambient temp 30C

RLA2 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	213.3Y/123.1	-	-2.56	-	7459	-	7459
Ht	102	100.0	206.9Y/119.4	1.31	-0.81	0.51	7459	104	7563
A/C	102	100.0	206.9Y/119.4	1.31	-0.81	0.50	7459	104	7563

Feeder  
 OCP Amps 200 (minimum = 110)  
 Type-Loc-Len THW Copper - OH 100ft  
 Conduit(s) (1) 2-1/2" EMT  
 Phase wires 3#3/0 (75C - 100% load)  
 Neutral wire #3/0  
 Ground wire #6 (NEC(r) 250-95)  
 Isolated Gnd -

Ambient temp 30C

RLA3 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym
				Cond	Trans	Total	Utility	Motors	Total
NL	-	-	213.3Y/123.1	-	-2.56	-	5271	-	5271
Ht	81	-	206.3Y/119.1	1.60	-0.81	0.79	5271	50	5321
A/C	81	-	206.3Y/119.1	1.60	-0.81	0.79	5271	50	5321

Feeder  
 OCP Amps 200 (minimum = 90)  
 Type-Loc-Len THW Copper - OH 180ft  
 Conduit(s) (1) 2-1/2" EMT  
 Phase wires 3#3/0 (75C - 100% load)  
 Neutral wire #3/0  
 Ground wire #6 (NEC(r) 250-95)  
 Isolated Gnd -

Ambient temp 30C



RLA4 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym Total
				Cond	Trans	Total	Utility	Motors	
NL	-	-	213.3Y/123.1	-	-2.56	-	5084	-	5084
Ht	75	-	206.3Y/119.1	1.58	-0.81	0.77	5084	46	5130
A/C	75	-	206.3Y/119.1	1.57	-0.81	0.77	5084	46	5130

Feeder  
 OCP Amps 150 (minimum = 80)  
 Type-Loc-Len THW Copper - OH 190ft  
 Conduit(s) (1) 2-1/2" EMT  
 Phase wires 3#3/0 (75C - increased)  
 Neutral wire #3/0  
 Ground wire #4 (increased size)  
 Isolated Gnd -

Ambient temp 30C

RLA5 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym Total
				Cond	Trans	Total	Utility	Motors	
NL	-	-	213.3Y/123.1	-	-2.56	-	6831	-	6831
Ht	61	-	207.1Y/119.6	1.19	-0.81	0.38	6831	81	6912
A/C	61	-	207.2Y/119.6	1.18	-0.81	0.38	6831	81	6912

Feeder  
 OCP Amps 150 (minimum = 70)  
 Type-Loc-Len THW Copper - OH 90ft  
 Conduit(s) (1) 2" EMT  
 Phase wires 3#1/0 (75C - 100% load)  
 Neutral wire #1/0  
 Ground wire #6 (NEC(r) 250-95)  
 Isolated Gnd -

Ambient temp 30C

RLA6 208Y/120V 3P 4W Lighting panel							- Feeder RLA		
Load	Load FLA	Load PF%	Voltage at equipment	Voltage drop %			Fault contrib -		RMS Sym Total
				Cond	Trans	Total	Utility	Motors	
NL	-	-	213.3Y/123.1	-	-2.56	-	12008	-	12008
Ht	84	-	208.0Y/120.1	0.78	-0.81	-0.03	12008	286	12294
A/C	84	-	208.0Y/120.1	0.77	-0.81	-0.03	12008	286	12294

Feeder  
 OCP Amps 200 (minimum = 90)  
 Type-Loc-Len THW Copper - OH 25ft  
 Conduit(s) (1) 2-1/2" EMT  
 Phase wires 3#3/0 (75C - 100% load)  
 Neutral wire #3/0  
 Ground wire #6 (NEC(r) 250-95)  
 Isolated Gnd -

Ambient temp 30C



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RLA7			208Y/120V 3P 4W Lighting panel				- Feeder RLA			
Load	Load	Load	Voltage at	Voltage drop %			Fault contrib -		RMS Sym	
	FLA	PF%	equipment	Cond	Trans	Total	Utility	Motors	Total	
NL	-	-	213.3Y/123.1	-	-2.56	-	7902	-	7902	
Ht	120	-	207.0Y/119.5	1.27	-0.81	0.46	7902	119	8021	
A/C	120	-	207.0Y/119.5	1.27	-0.81	0.46	7902	119	8021	
			Feeder							
OCP Amps			225	(minimum = 125)						
Type-Loc-Len			THW Copper	- OH 100ft						
Conduit(s)			(1) 2-1/2"	EMT						
Phase wires			3#4/0	(75C - 100% load)						
Neutral wire			#4/0							
Ground wire			#4	(NEC(r) 250-95)						
Isolated Gnd			-							
Ambient temp			30C							

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RLA8			208Y/120V 3P 4W Lighting panel				- Feeder RLA			
Load	Load	Load	Voltage at	Voltage drop %			Fault contrib -		RMS Sym	
	FLA	PF%	equipment	Cond	Trans	Total	Utility	Motors	Total	
NL	-	-	213.3Y/123.1	-	-2.56	-	7372	-	7372	
Ht	119	100.0	206.8Y/119.4	1.36	-0.81	0.55	7372	104	7476	
A/C	119	100.0	206.8Y/119.4	1.35	-0.81	0.55	7372	104	7476	
			Feeder							
OCP Amps			225	(minimum = 125)						
Type-Loc-Len			THW Copper	- OH 115ft						
Conduit(s)			(1) 2-1/2"	EMT						
Phase wires			3#4/0	(75C - 100% load)						
Neutral wire			#4/0							
Ground wire			#4	(NEC(r) 250-95)						
Isolated Gnd			-							
Ambient temp			30C							

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End of report

END OF SECTION



SECTION 16111

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rigid metal conduit.
- B. Intermediate metal conduit.
- C. Flexible metal conduit.
- D. Liquidtight flexible metal conduit.
- E. Electrical metallic tubing.
- F. Rigid PVC conduit.
- G. Fittings and conduit bodies.

1.2 RELATED SECTIONS

- A. Division 0 - Contract Requirements.
- B. Division 1 - General Requirements.
- C. Section 07270 - Fire Stopping.
- D. Section 07416 - Seam Metal Roof System.
- E. Section 07531 - Elastomeric Sheet Roofing
- F. Section 07536 - Modified Bitumen Roofing
- G. Section 07620 - Sheet Metal Flashing and Trim.
- H. Section 16010 - General Provisions - Electrical
- I. Section 16170 - Grounding and Bonding.
- J. Section 16180 - Equipment Wiring Systems.
- K. Section 16190 - Supporting Devices.
- L. Section 16191 - Seismic Restraint Systems.
- M. Section 16195 - Electrical Identification.

### 1.3 CODES AND STANDARDS

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.6: Intermediate Metal Conduit (IMC).
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. ANSI/NFPA 70 - National Electrical Code.
- F. NECA "Standard of Installation."
- G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- J. UL 1: Flexible Metal Conduit.
- K. UL 6: Rigid Metal Conduit.
- L. UL 360: Liquidtight Flexible Steel Conduit.
- M. UL 514B: Fittings for Conduit and Outlet Boxes.
- N. UL 651: Schedule 40 and 80 Rigid PVC Conduit.
- O. UL 797: Electrical Metallic Tubing.
- P. UL 886: Fittings for Use in Hazardous (Classified) Locations.
- Q. UL 1242: Intermediate Metal Conduit.

### 1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information for each type of conduit, conduit body, fitting and attachment device.

1. Conduit
  - a. Type of material
  - b. Thickness of material
  - c. Types of protective coatings on the outside and inside.
  - d. Type of protective coating on threads, if applicable.
2. Conduit Bodies
  - a. Type of material
  - b. Type of cover material
  - c. Type of protective coatings; interior and exterior.
  - d. Type of material for screws and gaskets.
3. Conduit Fittings
  - a. Type of materials such as bodies, gaskets, seals, etc.
  - b. Threaded
  - c. Compression or set screw type
  - d. Liquid tight
  - e. Concrete tight

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Record the actual routing of all feeder conduits to switchboards, panelboards, motor control centers, etc. and all underground conduit or conduit concealed in or under the slab in contact with the ground. Indicate the location of junction and pull boxes and sealing fittings and expansion fittings in these conduits. Dimension the locations of conduits, boxes and fittings on the drawings referenced from the exterior walls, columns or corners of the building. Record any modifications, deletions or additions to the branch circuitry indicated on the original drawings.

## 1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL label.

## 1.7 FIELD SAMPLES

- A. Provide under provisions of Sections in division 0 and 1.
- B. Provide field sample of each type of conduit, each at 2 feet (610 mm) long.
- C. Provide field sample of each type of fitting, one each.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Sections in division 0 and 1.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. The threads of rigid steel and IMC shall be protected by factory installed caps.
- D. Protect PVC conduit from sunlight.

## PART 2 PRODUCTS

### 2.1 METAL CONDUIT

- A. Manufacturers:
  - 1. Allied
  - 2. LTV Steel Tubular Products Co.
  - 3. Triangle
  - 4. Wheatland
  - 5. Substitutions: Under provisions of Sections in division 0 and 1.
- B. Rigid Steel Conduit (RSC): RSC shall be threaded, hot dip galvanized inside and outside with a chromate coating

outside. Threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.

- C. Intermediate Metal Conduit (IMC): IMC shall be threaded, hot-dip or electro-galvanized outside with chromate coating. The inside shall be galvanized or coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth, low friction surface. The threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.
- D. Couplings: Couplings shall be threaded, hot-dip or electro-galvanized steel with chromate coating and made by the same manufacturer as the conduit.

## 2.2 FLEXIBLE METAL CONDUIT

### A. Manufacturers:

- 1. AFC
- 2. Alflex Corp.
- 3. Anamet, Inc.
- 4. Electri-Flex Co.
- 5. Substitutions: Under provisions of Sections in division 0 and 1.

B. Description: Interlocked galvanized steel.

## 2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

### A. Manufacturers:

- 1. AFC
- 2. Alflex
- 3. Anamet Inc.
- 4. Carol
- 4. Electri-Flex Co.
- 5. Spiraduct
- 6 Substitutions: Under provisions of Sections in division 0 and 1.

- B. Description: Interlocked galvanized steel with extruded PVC jacket.

## 2.4 ELECTRICAL METALLIC TUBING (EMT)

### A. Manufacturers:

1. Allied Tube and Conduit.
2. LTV Steel Tubular Products Co.
3. Triangle PWC Inc.
4. Wheatland Tube Co.
5. Substitutions: Under provisions of Sections in divi

- B. Description: EMT shall be hot-dip or electro-galvanized on the outside with a chromate coating. The interior shall be coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth low friction surface.

## 2.5 NONMETALLIC CONDUIT

### A. Manufacturers:

1. Carlon
2. Can-Tex Industries
3. Georgia Pipe
4. Substitutions: Under provisions of Sections in division 0 and 1.

- B. Description: PVC; Schedule 40 and 80 PVC as indicated or specified.

- C. Fittings: Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit.

- D. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.



2.6 FITTINGS AND CONDUIT BODIES FOR METAL, EMT AND FLEXIBLE  
CONDUIT

A. Fittings

1. Manufacturers:

- a. Appleton
- b. Crouse-Hinds
- c. Raco
- d. O.Z./Gedney
- e. Midwest Electric
- f. Steel City
- g. Thomas and Betts

Substitutions: Under provisions of Sections in  
division 0 and 1.

2. Description:

- a. All fittings, locknuts, bushings, etc. shall be malleable iron or steel.
- b. For RSC or IMC, fittings shall be threaded type.
- c. For EMT, fittings shall be compression type.
- d. Locknuts shall have shape edges that bite into the enclosure when tightened.
- e. Bushings shall be high temperature plastic, with insulating throats and grounding lugs where applicable.
- f. Hub fittings shall be two-piece, liquid-tight with high temperature, plastic, insulating throats.
- g. Fittings used in concrete shall be UL Listed as concrete tight.
- h. Fittings used in exterior and other damp or wet applications shall be UL Listed as liquid tight.

- i. Fittings for flexible metal conduit have insulated throats and grounding lugs where applicable.
- j. Refer to the PVC coated metal conduit and nonmetallic conduit specifications for fittings used with those types of conduit.
- k. Sealing bushings shall have molded neoprene sealing ring with predrilled holes for each conductor, PVC coated pressure discs, stainless steel screws and washers and locking ring where applicable.

B. Conduit Bodies:

1. Manufacturers:

- a. Appleton
- b. Crouse-Hinds
- c. O-Z/Gedney
- d. Midwest Electric
- e. Steel City
- f. Raco
- g. Killark
- h. Substitutions: Under provisions of Sections in division 0 and 1.

2. Description: Conduit bodies shall be malleable iron or cast copper-free aluminum. They shall be threaded type with cast cover and solid gasket. Where used in dry interior applications, provide coated steel screws. Where used in exterior or other damp or wet applications, use stainless steel screws. Conduit bodies 1-1/4 inches (31mm) and larger shall have rollers or wire guards.

C. Expansion fittings:

1. Manufacturers:

- a. Appleton
- b. Crouse-Hinds

- c. O.Z./Gedney
  - d. Substitutions: Under provisions of Sections in division 0 and 1.
2. Description: These shall be malleable iron or steel with insulator bushing, gaskets, washers, packing, etc. as required to provide a complete unit. Provide a braided copper bonding jumper. The fitting shall be rated for interior or exterior use as applicable.

D. Seal Fittings:

- 1. Manufacturers
  - a. Appleton
  - b. Crouse-Hinds
  - c. O.Z./Gedney
  - d. Substitutions: Under provisions of Sections in division 0 and 1.
- 2. Description: Seal fittings shall be malleable iron or cast aluminum, threaded type with, packing, sealing compound, plugs, etc. to provide a complete unit. Fittings shall be rated for interior or exterior use as applicable.

E. Deflection Fittings

- 1. Manufacturers
  - a. Appleton
  - b. Crouse-Hinds
  - c. O.Z./Gedney
  - d. Substitutions: Under provisions of Sections in division 0 and 1.
- 2. Description: Deflection fittings shall be hot-dip galvanized ductile iron, threaded type with molded neoprene outer jacket, tinned braided copper bonding jumper, molded plastic inter sleeve, stainless steel clamping bands, etc. to provide a complete unit. The fitting shall be rated for interior or exterior use as applicable. Where fittings are used below grade, they

shall be PVC coated as specified under PVC coated metal conduit fittings.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### A. Underground Installation:

1. More than Five Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, or rigid nonmetallic conduit.
2. Within Five Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit or rigid nonmetallic conduit.
3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit or rigid nonmetallic conduit.

##### B. Outdoor Locations, Above Grade: Use rigid steel and intermediate metal conduit.

##### C. In Slab Above Grade:

1. Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing and rigid nonmetallic conduit.

##### D. Wet and Damp Locations: Use rigid steel conduit, intermediate metal conduit, and rigid nonmetallic conduit.

##### E. Dry Locations:

1. Concealed in concrete or masonry construction above grade, columns, walls and above suspended ceilings: Use rigid steel conduit, intermediate metal conduit, and electrical metallic tubing.
2. Exposed: use rigid steel, intermediate metal conduit, and electrical metallic tubing.

##### F. Locations Subject to Physical Damage: Use rigid steel conduit or intermediate metal conduit.

##### G. In refrigerated or hazardous areas: use rigid steel or intermediate metal conduit.

- H. Service Entrance Conduit - Underground (600 volts or less):  
Use rigid steel or schedule 40 PVC with the underground portion encased in a minimum of 3 inches (75 mm) of concrete and installed a minimum of 24 inches (600 mm) below grade. Convert PVC conduit to rigid steel before rising through the floor slab or grade. The rigid steel conduit shall extend a minimum of 6 inches (150 mm) above the floor or grade.
- I. Flexible Metal Conduit: Flexible metal conduit shall be installed for:
  - 1. Connections from the conduit system to recessed lighting fixtures, maximum 6 feet (1.8 m) in length.
  - 2. Connections to motors, maximum 2 feet (.6m) in length.
  - 3. Connections to electrical equipment subject to movement or vibration.
- J. Liquid-Tight Flexible Metal Conduit: Liquid-tight flexible metal conduit shall be installed for:
  - 1. Connections to motor or equipment subject to movement or vibration where exposed to rain, spray, or a corrosive atmosphere.
  - 2. Connections to equipment subject to oil or grease.
  - 3. Connections to fire pumps and auxiliary equipment.
- K. General Requirements:
  - 1. Install conduit in accordance with NECA "Standard of Installation" and manufacturer's written instructions.
  - 2. Install nonmetallic conduit in accordance with manufacturer's instructions.
  - 3. Minimum Size: 1/2 (13 mm) unless otherwise specified.
  - 4. Field measurements: Refer to 16010.
  - 5. Verify routing and termination requirements and locations of conduit prior to rough-in.
  - 6. Routing and termination of conduits shall be coordinated with structural, equipment, piping and ductwork to assure accessibility to junction and pull boxes.

7. Conduit routing shown on the drawings is diagrammatic unless otherwise dimensioned. Route conduit as specified and as required. Conduit offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation.
8. Finished Areas: Conceal conduits below floors, within slabs only where indicated, within walls, within pipe chases, above suspended ceilings, and within other building construction, unless otherwise indicated. Conduits shall not be run in floor slabs except where otherwise indicated.
9. Unfinished Areas: Install above-floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, storage areas, and other unfinished areas.
10. Install conduits run exposed or concealed above ceilings or in walls in straight, level and plumb lines, parallel with and at right angles with beams, wall, ceilings and other building lines.
11. Route conduit in slabs above grade and in and under slabs on grade from point-to-point or shortest practical path.
12. All individual suspended conduits (2-1/2" or larger) and all trapeze hangers where hanger rods are over 12 inches in length from the point of attachment to the structure, shall be provided with seismic sway bracing as indicated on the drawings. Conduits shall not be supported from the ceiling hanger wires or ceiling tee bars except for short runs of up to 3/4" (19 mm) branch circuit conduits which run from a wall or structural member and terminate in an outlet box mounted in or on the ceiling. Conduits supported on the ceiling tees shall be supported on the main runners only. A maximum of two 3/4" (19 mm) conduits may be supported from any single hanger wire and attached only in the upper and lower 12" (300 mm) of the hanger wire. Conduits shall not be run across and secured directly to the ceiling tee bar system that will prohibit the raising and removal of the ceiling tile. Additional hanger wires may be provided as conduit supports. These wires shall be the same size as the ceiling support wires and shall

- be attached to the ceiling grid and the structure above. They shall be tight without deforming the ceiling grid.
13. Arrange supports to prevent misalignment during wiring installation.
  14. Support individual conduit using coated steel or malleable one hole conduit straps, lay-in adjustable hangers, clevis hangers, threaded rods with conduit fasteners and split hangers.
  15. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Each conduit shall be independently attached to the rack.
  16. Fasten conduit supports to building structure and surfaces under provisions of Section 16190. Do not fasten conduit supports to mechanical piping or ducts or their supports.
  17. Do not support conduit with tie wire or perforated pipe straps. Remove wire used for temporary supports
  18. Do not cross conduits in slab.
  19. Conduit shall be installed a minimum of 12 inches (300 mm) from steam or hot water piping, flues or any other surface with a surface temperature exceeding 104 degrees F (40 degrees C) run in parallel with the conduit, and a minimum of 6 inches (150 mm) where run perpendicular to the conduit. Conduit shall be installed a minimum of 3 inches (75 mm) from cold or chilled water piping.
  20. Cut conduit square using saw or pipecutter; ream and de-burr cut ends.
  21. Bring conduit to shoulder of fittings; fasten wrench-tight.
  22. When threads are cut in rigid steel or intermediate metal conduit in the field, the conduit and fittings shall be made up immediately. If there are any threads showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.

23. When threads are cut in PVC coated rigid steel conduit in the field, the threads shall be coated immediately with a corrosion resistant compound supplied by the conduit manufacturer. When the PVC coating of the conduit is removed or damaged for any reason, the exposed area shall be coated with a PVC compound supplied by the conduit manufacturer. Follow the manufacturer's instructions in applying compounds.
24. Solvent weld nonmetallic conduit and fittings using cement as approved by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure as instructed by the manufacturer.
25. Use conduit hubs or water tight fittings to fasten conduit to metal boxes in damp and wet locations.
26. Install no more than equivalent of three 90-degree bends between pull or outlet boxes. Make field-made bends and offsets with hickey or conduit bending machine. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch (50 mm) size. Do not install crushed or deformed conduits. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. For banked runs, all bends and offsets shall be parallel.
27. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
28. Provide approved adapters when PVC conduits are coupled to metallic conduits.
29. Where PVC is used underground, a PVC coated rigid steel elbow shall be provided at the point where the conduit turns up. The vertical portion of the riser shall be PVC coated rigid steel conduit to a point 6 inches (150 mm) minimum above grade or floor slab.
30. Provide approved fittings that maintain conduit electrical continuity by bonding jumpers or other means to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
31. Provide seal fittings on all conduits where they rise out of the ground or fill below slabs. If the conduit terminates in a floor mounted metal enclosure such as a



switchboard, pull box, etc., provide a sealing bushing as specified with a grounding bushing.

32. Provide seal fittings on all conduits that penetrate exterior walls to or from interior spaces or other areas where conduit passes from one extreme temperature or moisture situation to another such as walk-in refrigerators, freezers or wash down bays.
33. Install a pull line in each empty conduit except sleeves and nipples in which wire or cable is to be installed by others if the conduit is more than 50 feet (15 m) in length and contains more than the equivalent of two 90 degree bends or where the conduit is more than 150 feet (45 m) in length. Pull lines shall be monofilament plastic having a minimum 200-pound (90 kg) tensile strength. Leave a minimum of 12 inches (300 mm) of slack at each end of the pull line.
34. Where conduits rise through floor slabs, curved portions of bends shall not be visible above the finished slab.
35. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.
36. Support horizontal and vertical runs of conduit at intervals in accordance with the code for the types of conduit used. In addition, support each riser conduit at each building floor level.
37. Prior to wire pulling, use suitable caps to protect installed conduit against entrance of dirt and moisture and blow out or swab out conduits in which moisture or dirt has collected. Free clogged conduits of obstructions.
38. Ground and bond conduit under provisions of Section 16170.
39. Identify conduit under provisions of Section 16195.
40. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction where conduit and other electrical items are not installed prior to concrete placing or masonry laying. Sleeves through concrete walls, concrete columns, and concrete beams shall be IPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all conduits passing through the

floor shall be galvanized IPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below.

41. Install conduit to preserve fire and smoke resistance rating of partitions, floors and other elements, using materials and methods approved by NFPA and the NEC.
42. Route conduit through suitable roof flashing devices. Coordinate with roofing installation specified under Section 07620.
43. Provide insulating bushings on all feeder conduits.
44. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations and every 150 feet (45 m) maximum for long straight runs.
45. All conduits that are stubbed out below grade shall have a threaded, watertight cap installed on the end.
46. Individual and grouped conduits suspended above accessible ceilings shall be located a sufficient distance above the ceiling to permit the removal of the ceiling tile.
47. Conduits shall be located so as not to hinder access to mechanical and electrical equipment through the ceiling tiles.
48. Exposed suspended conduits shall be located as to provide proper headroom as required by O.S.H.A. regulations.
49. Conduit runs shall be complete before conductors are installed in them.

L. EXCAVATION AND BACKFILL

1. Excavate and backfill as required for the electrical work. Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24 inch (600 mm) MINIMUM depth or as required by the NEC if more than 24 inches, (600 mm) from finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

2. After the underground electrical work has been installed and approved, place all backfill in 8 inch (200 mm) maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.
3. Warning tape for buried electrical work: Install detectable warning tape directly over every device by burying tape as close to the surface as possible, but no less than 6 inches (150 mm) beneath finish grade. One strip of warning tape shall be placed parallel and directly above the conduit. Where conduits are banked and the width of the conduit bank is over 12 inches (300 mm), strips shall be placed parallel, on 12 inch (300 mm) centers, centered directly above the conduit bank. Refer to Section 16195.

M. Conduits Embedded in Slabs:

1. Conduits shall be installed in slabs only where indicated.
2. Install in middle third of the slab thickness where practical, and leave a minimum of 1 inch (25 mm) concrete cover.
3. Do not stack conduits.
4. Outside diameter of the conduit shall not exceed 1/3 of the slab thickness.
5. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
6. Space raceways laterally to prevent voids in the concrete. Conduits shall be spaced no closer than 3 diameters on center except at cabinet locations.
7. Run conduit larger than 1-inch (25 mm) trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

END OF SECTION



SECTION 16113

UNDERFLOOR DUCTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Underfloor ducts.
- B. Underfloor junction boxes.
- C. Service fittings.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Section 07270 - Fire Stopping.
- C. Section 16010 - General Provisions - Electrical.
- D. Section 16111 - Conduit.
- E. Section 16123 - Building Wire and Cable.
- F. Section 16140 - Wiring Devices.
- G. Section 16170 - Grounding and Bonding.
- H. Section 16180 - Equipment Wiring Systems.
- I. Section 16741 - Interior Telephone, Pathways and Wiring.

1.3 CODES AND STANDARDS

- A. NECA (National Electrical Contractors Association)  
"Standard of Installation".
- B. NFPA 70 - National Electrical Code.
- C. UL884 - Underfloor Electrical Raceways and Fittings

1.4 SUBMITTALS: Submit under provisions of Sections in  
division 0 and 1. Refer to Section 16010.

- A. Shop Drawings: Indicate layout, setting height, insert  
spacing and height, locations of fittings and accessories,  
and overall dimensions.

B. Data Sheets: Submit as a minimum the following information on each different type and size of duct, junction box and service fittings. The information shall be in the form of manufacturer's standard data sheets and drawings.

1. Duct:

- a. Type of material
- b. Thickness of metal
- c. Outside dimensions
- d. Inside cross-sectional area
- e. Insert spacing, diameter and height
- f. Dimensioned picture of all fittings

2. Junction Boxes

- a. Type of material
- b. Thickness of metal
- c. Dimensions
- d. Divider and Tunnel arrangement
- e. Dimensioned picture of all fittings.
- f. Dimensioned section drawing indicating setting height, concrete cover, etc.

3. Service Fittings

- a. Type of material
- b. Dimensioned picture of all fittings
- c. Type and configuration of plates

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Codes and Standards. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Record actual locations of ducts, service fittings, junction boxes, duct markers, and branch circuiting arrangements. Dimension duct locations from columns and exterior walls.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Manufacturer's installation instructions and instructions for locating inserts and installing afterset inserts. Submittal data sheets.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Sections in division 0 and 1.
- B. Provide ten afterset inserts.
- C. Provide ten of each service fitting type.

- D. Provide two of each special tool required to install afterset inserts.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Square D.
- B. Walker
- C. Substitutions: Approved equal under provisions of Sections in division 0 and 1.

### 2.2 UNDERFLOOR DUCT

- A. Description: Steel duct with corrosion-resistant finish and without any preset devices. All activations will be by the afterset method. All underfloor equipment should be equipped with the proper flange depth to accomodate the approximate 2.25 inch thick concrete topping over the duct.
- B. Type: Underfloor.
- C. Configuration: One level system using ducts in parallel runs as shown on Drawings.
- D. Duct Type: 120 volt power: extra width size; communications: extra width size; special communications: standard size as indicated on the drawings.
- E. Standard Size: Minimum [1.25D x 3.125W inches (32 x 76 mm)] nominal.
- F. Extra Width Size: Minimum [1.5D x 6.5W inches (32 x 165 mm)] nominal.
- G. Inserts: Fabricate distribution lengths without any preset inserts. All activations will be by the afterset method. The afterset insert height shall be as required to support an approximate 2.25 inch thick concrete topping over the duct.
- H. Single Level Junction Boxes: Round cover of 1/4 inch [6 mm] thickness and trim, adjustable before and after the concrete pour. Provide internal barriers, wire routing tunnels, conduit and duct entrances, and extension rings as required. System ground continuity shall be maintained at the junction box.



- I. Junction Box Cover Plate: Provide tile trim plate flush with finished floor or carpet trim holders for .25 inch thick carpet as required.
  - J. Supports: Leveling legs and slotted screws for adjustment before concrete topping placement. Duct shall be supported at intervals per code.
  - K. Duct Markers: Corrosion resistant marker screws, with escutcheon.
  - L. Fittings and Accessories: Provide all conduit adapters, elbows, couplers and other accessories required for the installation of a complete system. All fittings shall be provided by the duct manufacturer.
- 2.3 SERVICE FITTINGS
- A. Underfloor duct opening for power and communication flex conduit connections to modular furniture:
    - 1. Using the afterset method: Install Walker #436-2-X, 2" IPS, depth as required, afterset insert fitting in the top of the underfloor power duct. Install a #1200 series single service fitting with a 1230 screw plug for the flex cables to exit the underfloor duct. Drill on a hole in the plug, as required for the connection of the flex conduit to the modular furniture.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install ducts aligned and leveled, parallel and perpendicular to building walls and column lines unless otherwise indicated.
- C. Locate duct in structural slab as indicated. See structural drawings. It is the contractor's responsibility to fully coordinate with all trades.
- D. All joints between components shall be sealed against concrete entry.
- E. Provide expansion fittings with suitable bonding jumper where duct crosses building expansion joints.

- F. Terminate ducts for telephone service 2 inches (50 mm) above floor in telephone closet using suitable fittings.
- G. Level cover plates flush with finished concrete floor.
- H. Place rectangular plates square with wall lines.
- I. Securely hold junction boxes and ducts in place during installation to avoid floating or other movement.
- J. Close unused duct or conduit entrances to junction boxes. Seal duct terminations at junction boxes. Use manufacturer's standard fittings designed for this purpose.
- K. Ground and bond duct under provisions of Section 16170.
- L. Place schedule on the inside of coverplate of each junction box indicating distance to first insert in each direction, measured from the center of the box. Use self-adhesive labels for schedule.
- M. Use blank duct for connecting parallel ducts less than 6 feet (1.8 m) apart, for feeder duct from cabinet, panelboard, etc. to first junction box, and where indicated.
- N. Support Couplers and Supports: Join duct lengths using combination support couplers. Provide additional supports at intervals of not over 5 feet (1.5 m), within 30 inches (750 mm) each side of junction boxes, and as close as practical to elbows, bends, and terminations. The support system shall maintain the height of the duct relative to the top of the finished slab elevation and maintain the spacing between the duct cells.
- O. Install insert within 12 inches (30 mm) of edge of junction box. Align inserts on same centers for all services.
- P. Do not extend inserts into special floor finishes, such as terrazzo, marble, or wood.
- Q. Install a duct marker in each insert adjacent to junction box, at end of each duct run, on both sides of permanent partitions, and on both sides of change of direction of duct. Install markers flush with finished floor material. In carpeted areas, install marker screws level with carpet backing.
- R. Install surface service fittings after installation of floor finishes. Cut floors as necessary, following duct

manufacturer's recommendations. Replace damaged floor construction and finish.

- S. Clean ducts and fittings of debris and dust before installing wire and cable.
- T. Pull wire and cable from outlet insert toward junction boxes.
- U. Install branch circuit conductors continuous between junction box and farthest fitting. Do not cut conductor to make connections to receptacle devices.
- V. Terminate ducts for power wiring in the bottom of the panelboards.

### 3.2 CLEANING

- A. Clean finished surfaces in accordance with manufacturer's instructions.

### 3.3 PROTECTION

- A. Protect finished installation under provisions of Sections in division 0 and 1.
- B. Protect boxes, covers, and rings from distortion and finish damage.
- C. Replace boxes, covers, and rings marred during construction.

END OF SECTION



SECTION 16123

BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions, - Electrical.
- B. Section 16111 - Conduit.
- C. Section 16112 - Surface Raceways.
- D. Section 16113 - Underfloor Duct.
- E. Section 16115 - Indoor Service Poles.
- F. Section 16130 - Boxes.
- G. Section 16170 - Grounding and Bonding
- H. Section 16180 - Equipment Wiring Systems.
- I. Section 16195 - Identification.

1.3 CODES AND STANDARDS

- A. NECA - Standard of Installation
- B. NEMA WC 5 - Thermoplastic - Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- C. NEMA WC 26 - Wire and Cable Packaging.
- D. NFPA 70 - National Electrical Code.
- E. UL 83 - Thermoplastic - Insulated Wires and Cables.
- F. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- G. UL 510 - Insulating Tape.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

A. Data Sheets: Submit as a minimum the following information on each different type of wire and connector. The information shall be in the form of manufacturer's standard data sheets or drawings.

1. Wire and Cable

- a. Conductor material
- b. Conductor gage or MCM
- c. Solid or stranded conductor
- d. Insulation material
- e. Insulation type designation
- f. Insulation temperature rating.

2. Wiring Connectors

- a. Connector Type
- b. Connector material
- c. Voltage, amperage and temperature ratings
- d. Conductor size ranges
- e. Tools required
- f. Picture of connector and tools
- g. Manufacturers installation instructions

3. Heat Shrink Material

- a. Type of material
- b. Wall thickness
- c. Voltage, and temperature ratings
- d. Conductor size ranges
- e. Tools required

- f. Picture of material and tools
      - g. Manufacturer's installation instructions
    - 4. Insulating Tape
      - a. Type of material
      - b. Thickness and width
    - 5. Wire Pulling Lubricants
      - a. Type of material
      - b. Types of conductor, insulation and conduit for which it is approved.
  - B. Megger Test Reports: Indicate values obtained.
  - C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Codes and Standards.
- 1.5 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Record actual wire and cable sizes on riser or single line diagrams or floor plans. Record actual circuit numbers by fixture and devices and on circuit homeruns.
- 1.6 QUALITY ASSURANCE
- A. Perform work in accordance with codes and standards listed in Section 16010.
  - B. Wire shall be manufactured within 12 months prior to the date of delivery to the site.
- 1.7 QUALIFICATIONS
- A. Manufacturer: Company specializing in the manufacturing of the products specified in this section with minimum three years documented experience.
- 1.8 OPERATION AND MAINTENANCE DATA
- A. Submit under provisions of Sections in division 0 and 1.

B. Refer to Section 16010.

C. Maintenance Data: Submittal data sheets on wire, cable, all connectors and accessories.

#### 1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

#### 1.10 PROJECT CONDITIONS

A. Conductor sizes are based on copper unless otherwise indicated.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

#### 1.11 COORDINATION

A. Coordinate Work under provisions of Sections in division 0 and 1.

B. Coordinate wire and cable sizes with actual installed equipment.

### PART 2 PRODUCTS

#### 2.1 BUILDING WIRE AND CABLE

##### A. Manufacturers

1. American Electric
2. Capitol Wire and Cable
3. Condumex Inc.
4. Diamond Wire
5. General Cable



6. Southwire
7. Triangle Wire
8. Approved equal under provisions of Sections in division 0 and 1.

B. BUILDING WIRE AND CABLE

1. Description: Single conductor insulated wire.
2. Conductor: Copper; 98 percent conductivity; solid for 10 AWG or smaller; stranded for larger than 10 AWG as applicable.
3. Insulation Thermoplastic; 600 volts, NFPA 70, Type THW TW THHN/THWN unless otherwise indicated; 75 degree C or 90 degree C.
4. All building wire shall be of the same manufacturer. Do not mix wire of different manufacturer on the same project.
5. Identification
  - a. General: All wires shall be identified as required by NEC.
  - b. The insulation on wiring #8 or smaller shall have factory-colored insulation. For wire larger than #8, color coding shall be colored tape wrapped around the insulation of each wire at each connection, splice and pull box. Each phase conductor of each branch circuit shall be of one color throughout the installation.
  - c. Color coding shall be as follows:
    - 1) 480/277 volt; three phase system:  
  
Phase A - Brown  
  
Phase B - Orange  
  
Phase C - Yellow  
  
Neutral - Gray  
  
Ground - Green

Isolated Ground - Green/Yellow

2) 208/120 volt, three phase system:

Phase A - Black

Phase B - Red

Phase C - Blue

Neutral - White

Ground - Green

Isolated Ground - Green/Yellow

3) 240/120 volt, single phase system:

Phase A - Black

Phase B - Red

Neutral - White

Ground - Green

Isolated Ground - Green/Yellow

4) 240/120 volt, three phase, 4 wire, delta system:

Phase A - Black

Phase B - Orange

Phase C - Blue

Neutral - White

Ground - Green

Isolated Ground - Green/Yellow

C. CONTROL WIRE

1. Description: Single conductor insulated wire.

2. Conductor: Copper; stranded for all sizes.

3. Insulation: Thermoplastic; 600, NFPA 70 Type MTW unless otherwise indicated; 75 degree C or 90 degree C as applicable.
4. All control wire shall be of the same manufacturer.
5. Identification: Control wire shall be color coded throughout. Each wire shall be identified at each terminal and junction point by permanently attached wire markers indicating the terminal number, etc. Refer to Section 16195.

## 2.2 WIRING CONNECTORS

- A. Solderless Spring-Wire Connectors: Tool-Applied, twist-on type with plastic caps; Rated for conductor sizes and material.

### 1. Manufacturers

- a. Buchanan-"B-Cap"
- b. Ideal- "Wing Nut"
- c. ITT Blackburn-"Free Spring"
- d. 3M - "Scotchlok"
- e. Panduit - "P-Conn"
- f. Thomas & Betts "Piggy"
- g. Approved equal under provisions of Sections in division 0 and 1.

- B. Compression Connectors and Taps: Mechanical set screw type or tool-applied crimp type. Split bolt connectors are not acceptable.

### 1. Manufacturers

- a. Blackburn
- b. Buchanan
- c. Burndy
- d. Ilsco
- e. Ideal

f. Thomas & Betts

g. Approved equal under provisions of Sections in  
division 0 and 1.

## 2.3 ACCESSORIES

A. Heat Shrink Material: heavy wall tubing or caps; UL  
Listed as waterproof.

### 1. Manufacturers

a. Ideal

b. Panduit

c. Raychem

d. 3M

e. Thomas & Betts

f. Approved equal under provisions of Sections in  
division 0 and 1.

B. Insulating Tape: Vinyl type; minimum 7 mil; listed for use  
as primary insulation and splice jacketing on 600 volt wire  
and cable.

### 1. Manufacturers

a. Plymouth - Premium III

b. 3M - Scotch 33+

c. Approved equal under provisions of Sections in  
division 0 and 1.

C. Wire Pulling Lubricants: Compatible with all conductor,  
insulation and conduit types.

### 1. Manufacturers

a. American Polywater

b. Buchanan

c. Condux

- d. CRC Chemicals
- e. Ideal
- f. Madison
- g. Approved equal under provisions on Sections in division 0 and 1.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Completely and thoroughly swab raceway where moisture and/or dirt has collected inside before installing wire.
- B. Do not install wire in conduit, raceways, etc. until they are complete and sealed against the entry of moisture and/or debris.

### 3.2 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- B. Exposed Dry Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- C. Above Accessible Ceilings: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- D. Wet or Damp Interior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- E. Exterior Locations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- F. Underground Installations: Use only building wire, Type TW THW THHN/THWN insulation, in raceway.
- G. Remote control, alarm and signal circuits: Type MTW insulation in raceway.
- H. Use wiring methods in accordance with the appropriate article of NFPA 70.
- I. Connect each circuit of a multi-circuit home run to a different phase.

- J. Do not terminate more than one conductor in a single terminal of a lug or connector.
- K. Leave slack conductor at each connection and splice to allow for future additional connections.

### 3.3 INSTALLATION

- A. Install products in accordance with the codes and standards herebefore specified and manufacturers instructions.
- B. Install all wiring in raceways unless otherwise indicated.
- C. Use conductor not smaller than 12 AWG for power and lighting circuits.
- D. Use conductor not smaller than 14 AWG for control circuits.
- E. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (23 m) to the furthest outlet.
- F. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (61 m) to the furthest fixture.
- G. Pull all conductors into raceway at same time.
- H. Use suitable wire pulling lubricant.
- I. Use a pulling means such as tape, rope, grips, etc. that will not damage the wire, cable or conduit.
- J. Neatly train and lace wiring inside boxes, equipment, cabinets, switchboards, and panelboards with nylon tie straps. Three phase circuits shall be grouped by circuit.
- K. Clean conductor surfaces before installing lugs and connectors.
- L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- M. Tighten set screws and bolts on connectors according to the manufacturer's torquing requirements.
- N. Use compression connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of the conductor.

- O. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- P. Where splices and taps are made in junction boxes or hand holes, etc. below grade use tool applied crimp type compression connectors. Insulate the conductors and the connector with heavy wall heat shrink material.

### 3.4 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 16195.
- B. Refer to Section 16130 for identification of contents of pull and junction boxes.
- C. In pull or junction boxes where there is more than one circuit, identify each conductor with its circuit number or other designation indicated on Drawings.

### 3.5 WIRING TEST

- A. Measure the insulation resistance of all feeder conductors using a "Megger". The test voltage shall be 500 volts. Test the conductor without circuit loads applied. The minimum resistance value shall be 1,000,000 ohms.

### 3.6 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Sections in division 0 and 1.
- B. Inspect wire for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

END OF SECTION





## SECTION 16130

### BOXES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Floor boxes.
- C. Pull and junction boxes.

##### 1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical.
- B. Section 16111 - Conduit.
- C. Section 16123 - Building Wire and Cable.
- D. Section 16140 - Wiring Devices.
- E. Section 16170 - Grounding and Bonding.
- F. Section 16180 - Equipment Wiring Systems.
- G. Section 16190 - Supporting Systems.
- H. Section 16195 - Electrical Identification.
- I. Section 16721 - Fire Alarm System.
- J. Section 16741 - Interior Telephone and Data, Pathways and Wiring.
- K. Section 16770 - Public Address System.

##### 1.3 CODES AND STANDARDS

- A. NECA - Standard of Installation.
- B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - E. NFPA 70 - National Electrical Code.
  - F. UL 514A - Metallic Outlet Boxes, Electrical.
- 1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.
- A. Data Sheets: Submit as a minimum the following information on each different type of outlet, floor, pull and junction box. The information shall be in the form of manufacturer's standard data sheet or drawings or shop drawings.
    - 1. Box material
    - 2. Wall or sheet metal thickness
    - 3. Dimensions
    - 4. Hub or knockout sizes
    - 5. Gasket material
    - 6. Cover plate material and thickness
    - 7. Picture of the box.
- 1.5 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Sections in division 0 and 1.
  - B. Accurately record actual sizes and locations of pull, and junction boxes in feeders. Dimension the location in reference to column lines and exterior walls.
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Data: Submittal data sheets or drawings.
- 1.7 QUALITY ASSURANCE
- A. Perform Work in accordance with codes and standard listed in Section 16010.

## 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the U.L. Label.

## 1.10 PROJECT CONDITIONS

- A. Verify locations of floor boxes and outlets prior to rough-in.
- B. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.
- C. Refer to Sections 16010 and 16180.

## PART 2 PRODUCTS

### 2.1 OUTLET BOXES

- A. Manufacturers
  - 1. Appleton
  - 2. Crouse-Hinds
  - 3. Killark
  - 4. O-Z/Gedney
  - 5. Raco
  - 6. Steel City
  - 7. Thepitt
  - 8. Approved equal under provisions of Sections in division 0 and 1.

- B. Sheet Metal Outlet Boxes: galvanized steel.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include male fixture studs where required.
  - 2. Boxes cast in concrete not in contact with earth: Concrete type.
- C. Cast Boxes: Type FD cast malleable iron or copper-free aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- D. Wall Plates: Refer to Section 16140.

## 2.2 FLOOR BOXES

- A. Manufacturers
  - 1. Hubbell
  - 2. Raco
  - 3. Steel City
  - 4. Thomas and Betts
  - 5. Walker
- B. Floor Boxes: fully adjustable with leveling screws and adjusting rings.
- C. Material: Cast metal or Formed steel.
- D. Shape: Rectangular.
- E. Conform to regulatory requirements for concrete-tight floor boxes.
- F. Service Fittings: Diecast aluminum, four piece, tombstone type with adapter plate, and other fitting as required to mount to the floor box. Provide device plates, and blank as required for devices indicated.

## 2.3 PULL AND JUNCTION BOXES

- A. Manufacturers
  - 1. Appleton

2. Crouse Hinds
  3. Hoffman
  4. Hope
  5. Keystone
  6. O-Z/Gedney
  7. Queen
  8. Approved equal under provisions of Sections in division 0 and 1.
- B. Sheet Metal Boxes: NEMA 1,12,3R or as indicated, galvanized steel.
- C. Hinged Enclosures: Refer to Section 16160.
- D. Surface-Mounted Cast Metal Box: NEMA, Type 4; flat-flanged, surface-mounted junction box.
1. Material: Galvanized cast iron or cast aluminum.
  2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- E. In-Ground Cast Metal Box: NEMA, Type 6, outside flanged, recessed cover box for flush mounting where indicated.
1. Material: Galvanized cast iron.
  2. Cover: Galvanized cast iron cover with neoprene gasket and stainless steel cover screws. Cover shall be smooth for below grade applications and nonskid for flush mounted applications.
  3. Cover Legend: As indicated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install boxes in accordance with NECA Standard of Installation and appropriate article of NFPA 70.

- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet, pull and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07270.
- G. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- H. Use flush mounting outlet boxes in finished areas.
- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic and fire rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- M. Use adjustable steel channel fasteners for hung ceiling outlet box. Channel fasteners shall be attached to the main runners or supports. The fastener shall be secured to the tee bar or ceiling support with a screw run thru the tee bar or support and the fastener at each point at which it is attached.
- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes to or from the structure independent of conduit, except cast outlet boxes that are connected to two

rigid metal conduits both supported within 12 inches (300 mm) of box.

- P. Use gang box where more than one device is mounted together. Do not use sectional box.
- Q. Use gang box with plaster ring for single device outlets.
- R. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- S. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- T. Set floor boxes level.
- U. Large Pull Boxes: Boxes larger than 100 cubic inches (1 600 cubic centimeters) in volume or 12 inches (300 mm) in any dimension.
  - 1. Interior Dry Locations: Use box with hinged cover or enclosure under provisions of Section 16160.
  - 2. Other Locations: Use surface-mounted cast metal box.
- V. All pull boxes and junction boxes shall be identified as to their contents. Boxes for power feeder and branch circuit wiring shall indicate the circuit numbers. Boxes for communication and control wiring shall indicate the system or what the wiring is for. The identification shall be written on the cover in bold characters using a wide tip, black, permanent marker.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for equipment furnished under other Sections. Refer to Section 16180.
- B. Coordinate locations and sizes of required access doors with Section 08305.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- D. Coordinate mounting heights of outlet boxes with the device mounting heights indicated on the drawings.
- E. Orient boxes to accommodate wiring device orientation.
- F. Align adjacent wall mounted boxes for switches, thermostats and similar devices.

- G. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- H. Position outlet boxes to locate light fixtures as shown on reflected ceiling plan.
- I. Coordinate with architectural, structural and mechanical so that boxes will be accessible.
- J. Provide access panels for junction or pull boxes above inaccessible ceilings or in chases.

### 3.3 ADJUSTING

- A. Adjust floor box flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closure in unused box opening.

### 3.4 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION



SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Device plates and box covers.
- E. Floor box service fittings.
- F. Poke-through service fittings.
- G. Photocell switches.
- H. Time switches.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions
- B. Section 16113 - Underfloor Duct
- C. Section 16123 - Building Wire and Cable
- D. Section 16130 - Boxes
- E. Section 16170 - Grounding and Bonding
- F. Section 16180 - Equipment Wiring Systems
- G. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

- A. NECA - Standard of Installation.
- B. NEMA WD 1 - General Requirements for Wiring Devices.
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
- D. NFPA 70 - National Electrical Code.

- E. UL 20 - General-use Snap Switches
  - F. UL 498 - Attachment Plugs and Receptacles
  - G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.
  - H. UL 917 - Clock Operated Switches.
  - I. UL 943 - Ground-Fault Circuit Interrupters
- 1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.
- A. Data Sheets: Submit as a minimum the following information on each different device. The information shall be in the form of manufacturer's standard data sheets.
- 1. Wall switches:
    - a. Grade
    - b. Number of poles
    - c. 3 or 4 way
    - d. Body and handle material
    - e. Color of handle
    - f. Voltage rating
    - g. Ampere rating
    - h. Dimensioned picture of the switch
  - 2. Wall Dimmers:
    - a. Type of circuitry of dimming, RFI filtering and voltage compensation.
    - b. On-off switch
    - c. Slide control
    - d. Materials for dimmer, plates, etc.
    - e. Color

- f. Voltage rating
  - g. Wattage rating
  - h. Dimensioned picture for the dimmer
- 3. Receptacles
  - a. Grade
  - b. Number of poles and wires
  - c. Grounding type
  - d. Material for body and face
  - e. NEMA configuration
  - f. Voltage rating
  - g. Amperage rating
  - h. Dimensioned picture of the receptacle
- 4. Floor Mounted Service Fittings
  - a. Housing or cover plate material
  - b. Device plate material and configuration
  - c. Number and types of devices
  - d. Pictures of required accessories
  - e. Dimensioned picture of the fitting or cover plate
- 5. Poke-Through Fittings
  - a. Material for fire stops, smoke barriers, raceways, boxes, service fitting housing, plates, etc.
  - b. Fire rating
  - c. Number and types of devices
  - d. Device plate configuration
  - e. Pictures of required accessories

- f. Dimensioned pictures of poke through fitting and service fittings.

- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the devices.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Record the location of all devices and the actual circuits to which they are connected.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Submittal data sheets.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standards listed in Section 16010.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

#### 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated. Products shall bear the UL Label.

#### 1.10 FIELD MEASUREMENTS

- A. The locations of devices indicated on the drawings are approximate. Coordinate the exact location with millwork and equipment.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:

1. Bryant 4900 Series
2. Hubbell 1220 Series
3. Arrow-Hart 1990 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Specification Grade, AC only general-use snap switch; single or double pole, 3 or 4 way as indicated.

C. Body and Handle: plastic with toggle handle. Handle color as indicated.

D. Ratings:

1. Voltage: 120-277 volts, AC.
2. Current: 20 amperes.

2.2 WALL SWITCH WITH PILOT LIGHT

A. Manufacturers:

1. Arrow-Hart - 1990 Series
2. Bryant - 4900 Series
3. Hubbell 1220 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy-Duty AC only general-use snap switch; single or double pole as indicated.

C. Body and Handle: Plastic with red toggle handle.

D. Indicator Light: Separate pilot strap with red color lens.

E. Ratings:

1. Voltage: 120-277 volts, AC

2. Current: 20 ampere

### 2.3 Fluorescent WALL DIMMERS

#### A. Manufacturers:

1. Lutron - ANova≡ Series
2. Lithonia -≡Monogram≡ Series
3. Prescolite -≡Element≡ Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Semiconductor dimmer with RFI filtering for electronic dimming ballasts and T8 lamps. The dimmer shall be compatible with the dimming ballast used.

C. Body and Handle: plastic with on/off switch and linear slide handle. Color shall be white.

D. Voltage: 277 volts.

E. Power Rating: 1000 watts.

### 2.4 15A DUPLEX RECEPTACLES

#### A. Manufacturers:

1. Bryant - 5262 Series
2. Hubbell - 5262 Series
3. Arrow-Hart - 5262 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type duplex receptacle.

C. Device Body: plastic with nylon face. Color as indicated.

D. Configuration: NEMA 5-15R.

E. Ratings:

1. 125 volts AC

2. 15 Amperes

2.5 20A, DUPLEX RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5362
2. Bryant - 5362
3. Hubbell - 5362
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type duplex receptacle.

C. Device Body: Plastic with nylon face. Color as indicated.

D. Configuration: NEMA 5-20R

E. Ratings

1. 125 volts AC
2. 20 amperes

2.6 GROUND FAULT INTERRUPTER RECEPTACLES

A. Manufacturers:

1. Arrow-Hart - GF 5342 Series
2. Bryant - GFR 53FT Series
3. Hubbell - 5362 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Specification Grade, 2 pole, 3 wire, grounding type, duplex receptacle, 5 ma sensitivity, feed thru type, test and reset buttons.

C. Device Body: Plastic with plastic or nylon face. Color as indicated.

D. Configuration: NEMA 5-20R

- E. Ratings
  - 1. 125 volts AC
  - 2. 20 Amperes

2.7 20A SINGLE RECEPTACLE, 125V

- A. Manufacturers:
  - 1. Arrow-Hart - 5361
  - 2. Bryant - 5361
  - 3. Hubbell - 5361
  - 4. Approved equal under provisions of Sections in division 0 and 1.
- B. Description: Specification Grade, 2 pole, 3 wire, grounding type, simplex receptacle.
- C. Device Body: Plastic with nylon face. Color as indicated.
- D. Configuration: NEMA 5-20R
- E. Ratings
  - 1. 125 volts AC
  - 2. 20 Amperes

2.8 30A SINGLE RECEPTACLE 125V

- A. Manufacturers:
  - 1. Arrow-Hart - 5716N Series
  - 2. Bryant - 9530 Series
  - 3. Hubbell - 9308 Series
  - 4. Approved equal under provisions of Sections in division 0 and 1.
- B. Description: Heavy Duty, 2 pole, 3 wire, grounding type simplex receptacle.
- C. Device Body: Black nylon, phenolic or urea.
- D. Configuration: NEMA 5-30R.



E. Ratings

1. 125 volts AC
2. 30 Amperes

2.9 20A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5461 Series
2. Bryant - 5461 Series
3. Hubbell - 5461 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy duty, 2 pole, 3 wire grounding type simplex receptacle.

C. Device Body: Plastic with brown nylon face.

D. Configuration: NEMA 6-20R

E. Ratings

1. 250 volt AC
2. 20 Amperes

2.10 30A HEAVY DUTY RECEPTACLE 250V

A. Manufacturers:

1. Arrow-Hart - 5700 Series, Nema 6-30R
2. Bryant - 9630 Series, Nema 6-30R
3. Hubbell - 9330 Series, Nema 6-30R
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy duty, 2 pole, 3 wire, grounding type simplex receptacle.

C. Device Body: Black nylon, phenolic, or Urea.

D. Configuration: NEMA 6-30R

E. Ratings

1. 250 volts AC
2. 30 Amperes

F. Contractor shall match the actual receptacle provided in this Section with the actual cord and plug provided with the equipment.

#### 2.11 50A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5709N Series
2. Bryant - 9650 Series
3. Hubbell - 9367 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy Duty, 2 pole, 3 wire, grounding type simplex receptacle.

C. Device Body: Black nylon, phenolic or urea.

D. Configuration: NEMA 6-50R

E. Ratings

1. 250 volts AC
2. 50 Amperes

#### 2.12 20A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5759 Series
2. Bryant - 9420 Series
3. Hubbell - 8410 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy Duty, 3 pole, 4 wire grounding type simplex receptacle.

C. Device Body: Black Bakelite, phenolic or urea.

D. Configuration: NEMA 14-20R

E. Ratings

1. 125/250 volts

2. 20 Amperes

#### 2.13 30A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5744 Series

2. Bryant - 9430

3. Hubbell - 9430 A Series

4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy Duty, 3 pole, 4 wire grounding type simplex receptacle.

C. Device Body: Black Nylon, RTP or urea.

D. Configuration: NEMA 14-30R

E. Ratings

1. 125/250 volts

2. 30 Amperes

#### 2.14 50A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-hart - 5754N Series

2. Bryant - 9450 Series

3. Hubbell - 9450A Series

4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy Duty, 3 pole, 4 wire, grounding type simplex receptacle.

C. Device Body: Black Nylon, RTP or urea.

D. Configuration: NEMA 14-50R

E. Ratings

1. 125/250 volts

2. 50 Amperes

#### 2.15 20A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 5781 Series

2. Bryant - 8420 Series

3. Hubbell - 8420 Series

4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Heavy Duty, 3 pole, 4 wire, grounding type simplex receptacle.

C. Device Body: Black Bakelite, phenolic or urea.

D. Configuration: NEMA 15-20R

E. Ratings

1. 250 volts

2. 20 Amperes

#### 2.16 30A HEAVY DUTY RECEPTACLE

A. Manufacturers:

1. Arrow-Hart - 8430N Series

2. Bryant - 8430 Series

- 3. Hubbell - 8430A Series
  - 4. Approved equal under provisions of Section Sections in division 0 and 1.
  - B. Description: Heavy Duty, 3 pole, 4 wire, grounding type simplex receptacle.
  - C. Device Body: Black Nylon, RTP or urea.
  - D. Configuration: NEMA 15-30R.
  - E. Ratings
    - 1. 250 volts
    - 2. 30 Amperes
- 2.17 50A HEAVY DUTY RECEPTACLE
- A. Manufacturers:
    - 1. Arrow-Hart - 8450N Series
    - 2. Bryant - 8450 Series
    - 3. Hubbell - 8450A Series
    - 4. Approved equal under provisions of Sections in division 0 and 1.
  - B. Description: Heavy Duty, 3 pole, 4 wire, grounding type simplex receptacle.
  - C. Device Body: Black Nylon, RTP or urea.
  - D0 Configuration: NEMA 15-50R
  - E0 Ratings
    - 1. 250 volts
    - 2. 50 Amperes
- 2.18 28 Volt DC Receptacle
- A0 Manufacturers:
    - 1. Bryant - 556 Series
    - 2. Hubbell - 5552-B Series

3. Approved equal under provisions of Sections in division 0 and 1.

B0 Description: Heavy duty, 2 pole, 2 wire simplex receptacle.

C0 Device Body: Black or brown phenolic.

D0 Configuration: NEMA 2-20R.

E0 Ratings

1. 250 volts DC

2. 20 amperes

#### 2.19 WALL PLATES

A0 Interior Cover Plate: 302 Smooth satin finish stainless steel with beveled edges or raised stamped steel as indicated.

1. Manufacturer

- a. Bryant

- b. Hubbell

- c. Arrow-Hart

- d. Approved equal under provisions of Sections in division 0 and 1.

B0 Weatherproof Cover Plate: Gasketed cast aluminum with hinged gasketed self closing device cover designed to fit over a type FS outlet box. All springs, screws and other hardware shall be stainless steel. The plate shall be UL Listed for wet locations with the cover closed.

1. Manufacturer

- a. Bryant

- b. Hubbell

- c. A-H

- d. Approved equal under provisions of Sections in division 0 and 1.

## 2.20 POKE-THROUGH FITTINGS

### A0 Manufacturers:

- 1 Hubbell - PT27A series
- 2 Square D - Fire-Gard-Ex
3. Thomas & Betts - FPT Series
- 4 Walker - 1600 Series
- 5 Approved equal under provisions of Sections in division 0 and 1.

B0 Description: Assembly comprising service fitting, separate raceways for power and communication wiring, poke-through components, fire stops and smoke barriers, and junction box for conduit termination for both power and communications.

C0 Fire Rating: 2 hours minimum.

### D0 Service Fitting:

- 1 Type: Pedestal multi-service type.
- 2 Housing: Aluminum
- 3 Device Plate: Stainless steel or aluminum.
- 4 Configuration: As indicated.
5. Devices: Number and type of devices as indicated.
6. Accessories: Provide mounting plates and other hardware as required for a complete installed unit.

## 2.21 PHOTOCELL SWITCHES:

### A0 Manufacturers:

1. Hubbell - PTA Series
2. Intermatic - K4100 Series
3. Paragon - CW Series
4. Tork - 2101 Series
5. Zenith - 9121 Series

6. Approved equal under the provisions of Sections in division 0 and 1.

B0 Description:

1. Cadmium sulphide light sensor.
2. Weatherproof diecast aluminum or polycarbonate housing with a Ultrasonic welded lexan or hermetically sealed glass sensor window, and threaded stem, nut and gasket.
3. Temperature range: -30 degrees F to + 140 degrees F.
4. Bimetal time delay switch.
5. Contacts shall be SPST snap action type rated for a minimum of 1800 watts for tungsten loads at 120 volts.
6. Adjustable from approximately 1 to 5 foot candles "on" to approximately 3 to 15 foot candles "off".

2.22 TIME SWITCHES:

A0 Manufacturers:

1. Intermatic - V45000 Series
2. Paragon - 4200 Series
3. Tork - 7000 Series
4. Approved equal under provisions of Sections in division 0 and 1.

B0 Description:

1. Astronomical dial
2. Day omitting
3. Manual override switch
4. Switch type: minimum 40 amp, 120 volt.
5. Spring wound carry-over to maintain operation for a minimum of 10 hours during a power outage.
6. Enclosure: code gage steel, NEMA 1 enclosure with manufacturer's standard enamel finish.



7. Mount enclosure with a minimum of four bolts. Refer to Section 16190 and 16191.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A0 Install in accordance with NECA "Standard of Installation", NFPA 70 and manufacturer's instructions.
- B0 Install devices plumb and level.
- C0 Install switches with OFF position down.
- D0 Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E0 Do not share neutral conductor on load side of dimmers.
- F0 Install receptacles with grounding pole on bottom.
- G0 Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- H0 Install plates on switch, receptacle, and blank outlets in finished areas.
- I0 Connect wiring devices by wrapping conductor around screw terminal.
- J0 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K0 Install protective rings on flush cover service fittings.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A0 Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights indicated on drawings.

### 3.3 FIELD QUALITY CONTROL

- A0 Inspect each wiring device for defects.
- B0 Operate each wall switch with circuit energized and verify proper operation.

C0 Verify that each receptacle device is energized.

D0 Test each receptacle device for proper polarity.

E0 Test each GFCI receptacle device for proper operation.

### 3.4 ADJUSTING

A0 Adjust devices and wall plates to be flush and level.

### 3.5 CLEANING

A0 Clean debris from outlet, and floor boxes and service fittings.

B0 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16160

CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hinged cover enclosures.
- B. Cabinets.
- C. Accessories.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16111 - Conduit
- C. Section 16123 - Building wire and Cable
- D. Section 16130 - Boxes
- E. Section 16170 - Grounding and Bonding
- F. Section 16180 - Equipment Wiring Systems
- G. Section 16190 - Supporting Devices
- H. Section 16191 - Seismic Restraint Systems
- I. Section 16195 - Electrical Identification
- J. Section 16741 - Interior Telephone, Pathways, and Wiring
- K. Section 16770 - Public Address and Music System

1.3 CODES AND STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each cabinet and enclosure. The information shall be in

the form of manufacturer's standard data sheets or drawings.

1. NEMA Rating
2. Metal gage backbox, cover and trim.
3. Mounting type
4. Mounting provisions for terminal blocks, etc.
5. Dimensions
6. Type of latch, lock and hinges
7. Type and color of finish

- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Record the actual locations of cabinets and enclosures with their designations.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Submittal data sheets on cabinets and enclosures.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in Section 16010.

## 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the U.L. Label.

## 1.10 MAINTENANCE MATERIALS

- A. Furnish under provisions of Sections in division 0 and 1.
- B. Provide two of each cabinet key.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Austin
- B. Hammond
- C. Hoffman
- D. Keystone
- E. Queen Products
- F. Robroy
- G. Approved equal under provisions of Sections in division 0 and 1.

## 2.2 HINGED COVER ENCLOSURES

- A. Construction: steel enclosure; NEMA Type as indicated.
- B. Size: As indicated.
- C. Covers: Gasketed steel with continuous hinge, held closed by flush latch operable by key to match branch circuit panelboard.
- D. Mounting: as indicated.

- E. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
- F. Knockouts: None
- G. Enclosure Finish: Manufacturer's standard gray enamel.

## 2.3 CABINETS

- A. Back Boxes: Galvanized steel; NEMA type as indicated.
- B. Size: As indicated.
- C. Fronts: Steel, flush or surface type with concealed trim clamps, concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with manufacturer's standard gray enamel.
- D. Mounting: As indicated.
- E. Knockouts: None.
- F. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.
- G. Provide interior metal panel or plywood backboard, as indicated, for mounting terminal blocks and electrical components. Finish the metal panel with white enamel. The plywood backboard shall be 3/4 inch (19mm) thick, A-D grade plywood with the A grade exposed and with a two-coat insulating varnish finish.
- H. Provide accessory feet for free-standing equipment.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install enclosures and boxes plumb. Anchor securely to wall, floor and structural supports at each corner. See Sections 16190 and 16191.
- C. Install cabinet fronts plumb.

- D. Identify the contents of the enclosure or cabinet with a laminated plastic nameplate engraved with 1/2 inch (13 mm) minimum height characters. The nameplate shall be white with black characters and securely attached to the outside front of the enclosure or cabinet.

END OF SECTION





SECTION 16170

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 RELATED SECTIONS

- A. All Division 16 Sections.

1.3 CODES AND STANDARDS

- A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedence, and Earth Surface Potentials of a Ground System.
- B. NFPA 70 - National Electrical Code.
- C. UL 467 - Electrical Grounding and Bonding Equipment
- D. UL 486A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.

1.4 GROUNDING ELECTRODE SYSTEM

- A. Metal underground water pipe.
- B. Metal frame of the building.
- C. Concrete-encased electrode.
- D. Ground ring (counterpoise).
- E. Metal underground gas piping system.
- F. Rod electrode.
- G. Plate electrode.
- H. Active electrode.

1.5 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 10 ohms maximum.

1.6 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each different item. The information shall be in the form of manufacturer's standard data sheets.

- 1. Rod Electrods

- a. Rod material
    - b. Dimensions
    - c. Coupling type

- 2. Mechanical Connectors

- a. Material
    - b. Connector type

- 3. Exothermic Connections

- a. Process description
    - b. Mold types
    - c. Weld material
    - d. Starting material

- 4. Grounding Well

- a. Dimensioned picture or drawing of grounding well and cover.
    - b. Well pipe material.
    - c. Well cover material and legend.

- B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

- C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Accurately record actual locations of grounding electrodes, counterpoise, test wells and other inground items. Dimension location from exterior walls and corners of the building.
- D. Record location of ground connections for transformers, service equipment and building steel.

#### 1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in division 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Submittal data sheets.

#### 1.9 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in SEction 16010.

#### 1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

#### 1.11 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:

1. Apache
2. Galvan
3. ITT Blackburn
4. Approved equal under provisions of Sections in division 0 and 1.

B. Material: Solid copper or Copper-clad steel with high-strength steel core and electrolytic grade copper outer sheath, molten welded to the core with tapered point and threaded ends.

C. Diameter: 5/8 inch (16 mm).

D. Length: 10 feet (3 m)per section.

E. Couplers: Exothermic welds

2.2 MECHANICAL CONNECTORS

A. Direct buried and Exposed Connectors

1. Manufacturers:

- a. Burndy
- b. Ilsco
- c. ITT Blackburn
- d. Thomas & Betts
- e. Approved equal under provisions of Sections in division 0 and 1.

2. Material: Bronze; mechanical set screw or bolt type or tool applied crimp type. Split bolt connectors are not acceptable.

B. Connectors in Enclosures, Boxes, etc.:

1. Refer to Section 16123.

## 2.3 EXOTHERMIC CONNECTIONS

### A. Manufacturers:

1. Burndy
2. Erico Products Inc.
3. Approved equal under provisions of Sections in division 0 and 1.

### B. Description:

1. Process: Exothermic process that produces molecular bonding of connected items.
2. Approved for exposure or direct burial without degradation.
3. Use graphite molds of proper size and design for the weld and connected items.
4. Weld material: Copper oxide and aluminum mixture with a minimum 3 percent tin.
5. Starting material: Aluminum, copper and iron oxides ignited only by spark ignitor designed for the purpose.
6. Miscellaneous: provide tools and other devices required for a complete weld.
7. All welding materials shall be of the same manufacturer.

## 2.4 WIRE

- A. Material: Copper, 98 percent conductivity; insulated copper for all feeders, branch circuits; bonding jumpers and transformer grounds; solid for 10 AWG and smaller, stranded for larger than 10 AWG. See Section 16123 for insulation types.
- B. Foundation Electrodes: Bare, stranded copper 4/0 AWG.
- C. Grounding Electrode Conductor: Insulated copper; size as indicated.
- D. Counterpoise: Bare, stranded, copper, 4/0 AWG.

## 2.5 GROUNDING WELL COMPONENTS

- A. Well Pipe: 8 inch (200 mm) diameter by 36 inch (1m) long concrete pipe with belled end.
- B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

## 2.6 STATIC GROUNDING RECEPTACLE

- A. Manufacturers
  - 1. Burndy - YTTAG Series
  - 2. Cadweld - B166 Series
  - 3. Approved equal under provisions of Sections in division 0 and 1.
- B. Description: Flush mounted combination tie-down and static grounding receptacle with 3/4 (19 mm) inch diameter attachment bar, cover and safety chain. The receptacle body, attachment bar and cover shall be made of a copper alloy casting. The receptacle shall be connected to the ground rod, size as indicated, with an exothermic weld connection.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

### 3.2 INSTALLATION

- A. Install Products in accordance with NFPA 70 and manufacturer's instructions.
- B. Ground-exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems.
- C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground. Locate a minimum of one-rod length from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade.

Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated. Proper driving studs and sleeves shall be used when driving ground rods. Water shall be continuously applied, to the ground at the point where the rod penetrates, during the driving process.

- D. Provide grounding well pipe with cover at each rod location indicated. Install well pipe top flush with finished grade.
- E. Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end. Provide supplemental grounding electrode as required by NFPA 70.
- F. Install braided-type bonding jumpers to connect ground clamps on water meter piping to bypass water meters electrically.
- G. Provide bonding jumpers as required by NFPA 70.
- H. Bond together metal siding not attached to grounded structure; bond to ground.
- I. Use exothermic welded connections for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and other electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- J. At Test Wells, use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- K. The building structural steel frame shall be grounded to the building service grounding electrode, using the conductor size indicated.

- L. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench tight.
- M. Where expansion joints or telescoping joints occur, provide bonding jumpers.
- N. Where flexible metallic conduit is employed, provide a green-insulated grounding jumper installed in the flexible conduit.
- O. Provide grounding bushings on all service and feeder raceways terminating within switchboards, motor control centers, panelboards, cabinets, and all other enclosures. Provide grounding conductors from such bushings to the frame of the enclosure and to the ground bus or equipment grounding strap.
- P. Provide separated isolated grounding conductor within each feeder or branch circuit raceway for circuits where indicated. Refer to Section 16123 for identification.
- Q. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Refer to Section 16123 for identification.
- R. Where paralleled conductors in separate raceways occur, provide a grounding conductor in each raceway.

### 3.3 COORDINATION WITH OTHER SYSTEMS

- A. Coordinate connections to and requirements for grounding for site lighting, lightning protection, telephone, alarm and communication systems. Refer to appropriate specification section. All systems shall be bonded together as required by the NFPA 70.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

### 3.5 TESTING

- A. The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 10 ohms under normally dry conditions. If this resistance cannot



be obtained with a single rod, additional rods not less than one rod length on center, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 10 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations.

END OF SECTION



SECTION 16180

EQUIPMENT WIRING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to Government-furnished equipment and equipment specified under other sections.

1.2 RELATED SECTIONS

- A. Division 0 - Contract Requirements.
- B. Division 1 - General Requirements
- C. Division 11 - Equipment
- D. Division 12 - Furnishings
- E. Division 14 - Conveying Systems
- F. Division 15 - Mechanical
- G. 16010 - General Provisions, Electrical
- H. 16111 - Conduit
- I. 16123 - Building Wire and Cable
- J. 16130 - Boxes
- K. 16140 - Wiring Devices
- L. 16170 - Grounding and Bonding
- M. 16190 - Supporting Devices
- N. 16195 - Electrical Identification
- O. 16441 - Enclosed Switches
- P. 16470 - Panelboards
- Q. 16476 - Enclosed Circuit Breakers
- R. 16481 - Enclosed Motor Controllers

### 1.3 CODES AND STANDARDS

- A. Refer to Section 16010.
- B. Specific codes and standards listed in applicable Division 16 sections for equipment, devices, wiring, etc. used for connection to equipment.

### 1.4 REGULATORY REQUIREMENTS

- A. Refer to Section 16010.

### 1.5 EQUIPMENT CONNECTIONS

- A. Contractor shall make connections to Government-furnished equipment and equipment furnished by other sections requiring electrical connections. Provide miscellaneous items such as disconnect switches, starters, plugs, receptacles, boxes, conduit, wire cords, etc. as indicated and required to make the connection.

### 1.6 CONTROL WIRING

- A. Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be furnished under the other sections of the specifications.

### 1.7 COORDINATION

- A. Refer to applicable sections of Division 1.
- B. Obtain and review shop drawings, rough-in drawings, product data, and manufacturer's instructions for equipment furnished under other sections to determine connection locations and requirements.
- C. Capacities of feeders, motor starters, circuit breakers, switches, protective devices, and other electrical devices indicated to be furnished and installed by the Electrical Section for electrically operated equipment, regardless of who furnishes and/or installs that equipment, are based upon the average horsepower and/or electrical ratings of the types and sizes of the equipment used. Before

commencing electrical work for electrically operated equipment, the electrical section shall: check horsepower and/or electrical rating of each individual electrically operated equipment items, regardless of who furnished and/or installs that equipment.

- D. Switches, circuit breakers, motor starters, protective devices, and other electrical devices furnished by other Sections and by others for installation and/or wiring by Electrical Section, are specified elsewhere to have adequate capacities to serve the electrically operated equipment which they are furnished. However, BEFORE installing and/or wiring each of these devices, the Electrical Section shall check each individual device's electrical rating with the horsepower and/or electrical rating of the corresponding electrically operated equipment actually installed, regardless of who furnishes and/or installs the devices and equipment. The Electrical Section shall not install and/or wire any device that is found to be the incorrect size. The Contractor shall notify the Resident Officer In Charge of any such discrepancies.
- E. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- F. Sequence electrical connections to coordinate with start-up schedule for equipment.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Equipment, devices, wiring, etc. as required shall be as specified in the appropriate Division 16 section.

### 2.2 CORDS AND CAPS

- A. Plug Configuration: match receptacle configuration at outlet provided for equipment where applicable.
- B. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations. Maximum length - 6 feet.
- C. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

## 2.3 RECEPTACLES

- A. Configuration: match configuration for plug provided with equipment where applicable.

## PART 3 EXECUTION

### 3.1 ELECTRICAL CONNECTIONS

- A. All electrical outlets, switches, starters, etc. shall be installed in approximately the locations indicated. Adjustments shall be made as required, to avoid interferences with installed equipment, work by other divisions, and structure. Code required clearances shall be maintained around electrical equipment. Electrical equipment shall not be installed as to interfere with the working and maintenance spaces of equipment provided by other sections.
- B. Electrical equipment, fixtures, outlets and connections to equipment furnished by others may be moved up to ten feet from the location shown on the drawings without any cost to the owner if the contractor is notified before the electrical work for that item is installed.
- C. Electrical equipment, devices, wiring, etc. shall be installed in accordance with the appropriate Division 16 section.
- D. Extend wiring to the equipment and make proper connections thereto.
- E. Make electrical connections in accordance with equipment manufacturer's instructions.
- F. Where indicated, make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations. Flexible conduits with a minimum length of 18 inches or 12 times the diameter of the conduit whichever is greater, shall be provided to all equipment subject to periodic removal, vibration, or movement and for all motors.
- G. Make connections to motors, not near walls or columns, with a vertical rigid metal conduit, minimum size 3/4", attached to the floor and ceiling. Wiring shall be carried into and out of this conduit by means of condulets and flexible conduit.

- H. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- I. Provide receptacle outlet where connection with attachment plug is indicated. Install the receptacle as close as practicable to the equipment served. Provide cord and cap where field-supplied attachment plug is indicated.
- J. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- K. Provide interconnecting conduit and wiring between devices and equipment where indicated.
- L. Coolers and Freezers: Provide seal fittings in conduits through freezer and cooler walls, floor, and ceilings.
- M. Motors: All motors shall be provided with separate grounding conductors.

END OF SECTION





SECTION 16190  
SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel channel for conduit and equipment supports.
- B. Anchors and fasteners.
- C. Spring steel clips
- D. Hangers, Clamps and fittings.
- E. "J" hook hangers
- F. Cable ties

1.2 RELATED SECTIONS

- A. All Division 16 Sections.

1.3 CODES AND STANDARDS

- A. NECA - Standard of Installation
- B. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Product Data: Provide manufacturer=s standard catalog data for fastening and support devices and channel.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, and preparation, installation, of the Product.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in Section 16010.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

## PART 2 PRODUCTS

### 2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. Anchors and Fasteners:
  - 1. Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts as applicable.
  - 2. Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners as applicable.
  - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
  - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
  - 5. Solid Masonry Walls: Use expansion anchors and preset inserts.
  - 6. Sheet Metal: Use sheet metal screws.
  - 7. Wood Elements: Use wood screws.

## 2.2 STEEL CHANNEL

### A. Manufacturer:

1. Allied
2. B-Line
3. Kindorf
4. Superstrut
5. Unistrut
6. Approved equal under provisions of Sections in division 0 and 1.

- B. Description: 14 gauge minimum Galvanized or Painted steel with factory punched attachment holes. Nuts, bolts, straps and other accessories shall be designed for use with the channel.

## 2.3 SPRING STEEL CLIPS

### A. Manufacturer:

1. B-Line
2. Erico
3. Approved equal under provisions of Sections in division 0 and 1.

## 2.4 HANGERS, CLAMPS AND FITTINGS

### A. Manufacturer:

1. Allied
2. B-Line
3. Kindorf
4. Superstrut
5. Unistrut
6. Approved equal under provisions of Sections in division 0 and 1.

B. Description: Galvanized steel.

2.5 "J" HOOK HANGERS

A. Manufacturer:

1. B-Line
2. Michigan
3. PHD
4. Approved equal under provisions of Sections in division 0 and 1.

B. Description: 4 inch (101 mm) galvanized steel, straight "J" hook pipe hanger.

2.6 CABLE TIES

A. Manufacturer:

1. 3M
2. Ideal
3. Panduit
4. Thomas & Betts
5. Approved equal under provisions of Sections in division 0 and 1.

B. Description: One piece, nylon.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with NFPA 70 and the manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use tie wire, perforated pipe straps or nylon ties to support conduits.

- E. C-clamps or beam clamps shall have strap or rod-type retainers.
- F. Raceways or pipe straps shall not be welded to steel structures.
- G. In partitions of light steel construction, sheet-metal screws may be used.
- H. Load applied to fasteners shall not exceed one-fourth test load.
- I. Fasteners attached to concrete ceiling shall be vibration-resistant and shock-resistant.
- J. Where raceway, boxes and equipment is supported on gypboard and studwalls, vertical and horizontal bracing in the wall shall be provided to support the weight of the raceway, etc. and to receive the screws.
- K. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- L. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- M. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- N. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- O. Provide cable hangers as indicated on the drawings for all cables that are allowed to be run without conduit. The hangers shall consist of typical 4" (100 mm) straight J-hook pipe hangers secured to each stud on 48" centers with standard sheetrock screws of length required to penetrate and secure to the stud. There shall be 3 rows of these hooks along the corridor walls indicated.

Where crossing from one side of the corridor to the other or across open spaces, vertical and horizontal supports as required shall be provided to support the hooks. Where ducts and pipes are encountered, the hooks may be separated to allow cables to be routed above and below the duct and pipes.

END OF SECTION



SECTION 16191

SEISMIC RESTRAINT SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Seismic restraint systems.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16111 - Conduit
- C. Section 16130 - Boxes
- D. Section 16160 - Cabinets and Enclosures
- E. Section 16190 - Supporting Devices
- F. Section 16441 - Enclosed Switches
- G. Section 16461 - Dry Type Transformers
- H. Section 16470 - Panelboards
- I. Section 16476 - Enclosed Circuit Breakers
- J. Section 16481 - Enclosed Motor Controllers
- K. Section 16485 - Contactors
- L. Section 16511 - Interior Luminaires
- M. Section 16721 - Fire Alarm Systems
- N. Section 16741 - Interior Telephone and Data, Pathways, and Wiring
- O. Section 16770 - Public Address and Music System

1.3 CODES AND STANDARDS

- A. SBC - Standard Building Code with amendments.
- B. UBC - Uniform Building code with amendments.
- C. BOCA - Basic National Building code with amendments.

- D. State and Local Codes
- E. SMACNA - Guidelines for Seismic Restraint
- 1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.
  - A. Data Sheets: Submit manufacturer's standard catalog data sheets for each different restraint device, anchors, etc.
  - B. Shop Drawings: Dimensioned shop drawings for each restraint application.
  - C. Calculations.
  - D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, and installation, of the devices.
- 1.5 OPERATION AND MAINTENANCE DATA
  - A. Submit under provisions of Sections in division 0 and 1.
  - B. Maintenance Data: Submittal data sheets, shop drawings and calculations.
  - C. Refer to Section 16010.
- 1.6 QUALITY ASSURANCE
  - A. Perform Work in accordance with codes and standard listed in Section 16010.
- 1.7 QUALIFICATIONS
  - A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- 1.8 REGULATORY REQUIREMENTS
  - A. Conform to requirements of NFPA 70.
  - B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.



## 1.9 FIELD MEASUREMENTS

- A. Take dimensions and measurements from architectural and structural drawings or in the field.

## 1.10 GENERAL REQUIREMENTS

- A. All electrical equipment shall be protected for no interruption of service, utilizing snubbers, neoprene mounting brackets with captive steel inserts as required. Equipment shall be protected for seismic, zone 3 with a  $z=.30$  and with an importance factor of 1.0.
- B. All isolators and isolation materials shall be of the same manufacture and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specifications shall be corrected by the contractor in an approved manner at no cost to the Government.
- C. Refer to the seismic restraint schedule which lists isolator type, isolator deflections and seismic restraint type.
- D. All equipment whether isolated or non-isolated must include verifying calculations and analysis.
- E. Contractor shall install all isolators and restraints per written installation instructions submitted by isolation/seismic restraint manufacturer.

## 1.11 MANUFACTURER RESPONSIBILITIES

- A. Determine vibration isolation and seismic restraint sizes and locations including restraint anchorage to structure and equipment.
- B. Provide electrical equipment isolation systems and seismic restraints as scheduled, specified and required.
- C. Provide installation instructions and drawings.
- D. Provide calculations to determine restraint loads resulting from seismic forces presented in the applicable codes and standards, applied at the equipment center of mass. Seismic calculations shall be certified by a licensed engineer in a seismic zone equal to or greater than the project requirements in the employ of the vendor for not less than 3 years and experienced in the design of restraints for flexible mounted equipment.

- E. Provide certification of seismic restraint capability to safely accept loads resulting from seismic forces determined by methods defined in Paragraph D, above. Certification must be substantiated by calculations or test reports verified by a licensed engineer.
- F. Manufacturers:
  - 1. Mason Industries
  - 2. Peabody
  - 3. Approved equal under provisions of Sections in division 0 and 1.

## PART 2 PRODUCTS

### 2.1 PROTECTION DEVICES

#### A. Protection Device #1

Restraints shall be made of plate, structural members or square metal tubing concentric within a welded assembly incorporating resilient pads. Angle bumpers are not acceptable. Equipment incorporating this seismic restraint must include a minimum of four (4) all directional snubbers consisting of a minimum 5/8" (16 mm) thick replaceable resilient elastomer. System to be field bolted or welded to deck.

#### B. Protection Device #2

Restraints of all suspended individual conduits 2-1/2" (63 mm) in diameter or larger, and all trapeze conduit hangers shall consist of steel cables arranged to achieve the required all-directional restraint and sized to resist seismic loads. Submittal drawings shall indicate proposed method of achieving vertical restraint where required. Cables shall be installed with sufficient slack to avoid short circuiting any vibration isolators or as approved.

#### C. Protection Device #3

Non-isolated equipment to be field bolted to resist seismic forces. Calculations showing anchor bolt type, size, embedment and number shall be provided and stamped by registered engineer, overturning calculations shall be provided and stamped.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Except as otherwise indicated, seismic protection shall comply with manufacturer's instructions for the installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points.

3.2 ELECTRICAL EQUIPMENT SCHEDULE

EQUIPMENT	PROTECTION DEVICE	DEFLECTION
All Distribution and Branch Circuit Panelboards	3	
Pad Mounted Transformers	1,3	Part 1
Fire Alarm Control panel, Public Address Amplifier Cabinets	2	
Suspended Conduits 2-1/2" and larger and trapeze hangers	2,3	
Wall Mounting Disconnect Switches, Motor Starters, Circuit Breakers, Contactors, Relays & Time Switches	3	
Dry Type Stepdown Transformers	1,3	Part 1
Lighting Fixtures	2	

END OF SECTION



SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Identification Plates.
- B. Wire and cable markers.
- C. Underground Utility Warning tape.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16123 - Building Wire and Cable.
- C. Section 16160 - Cabinets and Enclosures
- D. Section 16441 - Enclosed Switches
- E. Section 16461 - Dry Type Transformers
- F. Section 16470 - Panelboards
- G. Section 16476 - Enclosed Circuit Breakers
- H. Section 16481 - Enclosed Motor Controllers
- I. Section 16485 - Contactors
- J. Section 16721 - Fire Alarm System
- K. Section 16741 - Interior Telephone and Data, Pathways, and Wiring
- L. Section 16770 - Public Address and Music System

1.3 CODES AND STANDARDS

- A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Product Data: Provide manufacturer's standard catalog data for nameplates, and markers.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

- A. Engraved, Plastic-Laminated Identification Plates: Engraving stock melamine plastic laminate, 1/16-inch (1.6 mm) minimum thick for signs up to 20 square inches (12,500 square mm), or 8 inches (200 mm) in length; 1/8 inch (3 mm) thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners. Edges shall be chamfered. Plates shall be fastened with black-finished round-head screws or rivets, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location.
- B. Locations:
  - 1. Refer to each related section for detailed information about plate locations and wording.
- C. Letter Size:
  - 1. Use 1/4 inch (6 mm) letters for identifying individual equipment and loads.

2. Use 1/2 inch (12 mm) letters for identifying grouped equipment and loads.
3. Use 1/2 inch (12 mm) letters for identifying Panelboards and cabinets.

## 2.2 WIRE AND CABLE MARKERS

### A. Wire and cable designation tape markers.

1. Manufacturers:
  - a. Seton
  - b. Almetek
  - c. Thomas and Betts
  - d. Panduit
  - e. Approved equal under provisions of Sections in division 0 and 1.
2. Description: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

### B. Colored Adhesive Marking Tape

1. Manufacturers
  - a. 3M
  - b. Plymouth
  - c. Thomas and Betts
  - d. Approved equal under provisions of Sections in division 0 and 1.
2. Description: Self-adhesive vinyl tape not less than 7 mils thick by 3/4 inch to 2 inches in width.

### C. Locations: Refer to each related section for detailed information about locations and indications.

## 2.3 UNDERGROUND UTILITY WARNING TAPE

### A. Manufacturers:

1. Seton
2. Thomas & Betts
3. Almetek
4. Panduit
5. Approved equal under provisions of Sections in division 0 and 1.

- B. Description: Minimum 4 mils thick, 6 inch (150 mm) wide composition metallized foil-plastic film laminate, detectable type, colored red with suitable permanent, continuous-printed, warning legend describing buried electrical lines. Tape shall be formulated for prolonged use underground.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive plates and markers.

### 3.2 APPLICATION

- A. Install identification plates parallel to equipment lines.
- B. Install all products in accordance with manufacturer's instructions.
- C. Refer to Section 16111 for installation requirements for underground utility warning tape.

END OF SECTION



SECTION 16421

UTILITY SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.
- B. Underground service entrance as indicated.
- C. Metering equipment.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavating.
- B. Section 02223 - Backfilling.
- C. Section 02225 - Trenching.
- D. Section 03300 - Cast-in-Place Concrete: Transformer pads.
- E. Section 16010 - General Provisions - Electrical.
- F. Section 16111 - Conduit.
- G. Section 16123 - Building Wire and Cable.
- H. Section 16170 - Grounding and Bonding.
- I. Section 16470 - Panelboards.

1.3 CODES AND STANDARDS

- A. NFPA 70 - National Electrical Code.

1.4 SYSTEM DESCRIPTION

- A. System Characteristics: 480Y/277 volts for the Training Building, 60 Hertz.

1.5 SUBMITTAL: Submit under provisions of Sections in divisions 0 and 1. Refer to Section 16010.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Record actual location of utility poles, transformers, primary feeders and other equipment. Dimension underground conduits referenced from building exterior walls and corners.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. All products shall bear the UL Label.
- C. Conduits, vaults, pads, metering enclosures, etc shall be finished and installed in accordance with requirements of the Seattle City Light Company. A copy of the requirements is enclosed at the end of this section.

PART 2 PRODUCTS

2.1 UNDERGROUND ELECTRICAL SERVICE

- A. Division 16 contractor shall:
  - 1. Furnish and install all underground primary and secondary conduits as shown on the drawings including opening and closing trenches.
  - 2. Furnish and install low voltage underground building service conductors from building service equipment to and up through service transformer concrete pad into service transformer load side compartment.
  - 3. Furnish and install concrete vaults as indicated on drawings.
  - 4. Furnish and install the concrete transformer pad.

5. Furnish and install CT cabinet and conduit for metering.
6. See additional requirements of Seattle City Light in 3.4.
7. Make arrangements with Electric Utility Company for any service fees, etc. PAY ALL CHARGES THEREFORE, AND INCLUDE COST THEREOF IN CONTRACT PRICE. The current estimate of these costs is \$15,000. Coordinate work of Division 16 with that of the electric utility company (~~Tom Dunlap~~Terry Nosal; Seattle City Light Co., North Service Center, 1300 North 97th Street, Seattle, WA, 98103, Phone: 206-~~684-4983386~~9110, 7-9:30 a.m., Tuesday through Friday).

B. The Utility Company shall:

1. Furnish and install service padmount transformer on pad and make all primary and secondary conductor connections.
2. Furnish and install the primary service cables.
3. Furnish and install metering CT=s in CT cabinet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

- A. Make arrangements with Owner and Utility Company for all needed power outages.

3.3 INSTALLATION

- A. Install all conduit, wire, etc. in accordance with the appropriate specification, and the Utility Company's requirements.

3.4 REQUIREMENTS OF SEATTLE CITY LIGHT

- A. Provide and install an electrical service that shall comply with City Light's Requirements for Electric Service Connection manual and the City Light rate ordinance in effect at the time City Light approves the service for connection.

- B. Observe specifications, written details, and sketches showing equipment locations and dimensions as indicated by the City Light project engineer.
- C. The contractor shall be responsible to prevent water from entering the service equipment or the building through the service conduit or the conduit entrance.
- D. Ambient noise levels for padmount transformers are higher than subway-installed transformers. The installation shall meet all applicable noise-level ordinances.
- E. The contractor is responsible for isolating the transformer vault or pad so that sound and vibration levels satisfy the applicable laws and ordinances of the Washington Administrative Code, King County, and the City of Seattle.
- F. Phone 1-800-424-5555, 48-hours in advance of any digging so that underground utilities can be located and marked.
- G. Secure the necessary permit to trench in the public right-of-way, phone 684-5269 or 684-5270 for permit information. The conduit must have 36-inches minimum cover in the public right-of-way and easement areas per City Light Construction Guideline U2-10 and 18 inches minimum on private property per City Light Construction Guideline U12-1.4.
- H. State law requires any construction work, temporary structures or equipment to maintain a 10-foot clearance from City Light power lines (WAC296-24-960). If this project requires work in proximity to any energized lines, or relocate the lines temporarily. This work will be done at the contractor's expense on a estimated time and material basis. The estimate must be paid in advance of any work. The final actual cost will be determined when the work is completed.
- I. Pulling Vault: Provide and install one 644 primary pulling vault per Construction Guideline U2-14.2.
- J. Pad Location: Make sure the pad location will comply with Chapter 4 of the Building Code and City Light Construction Guideline U10-2i.e., not less than 10 feet from any property line, nor closer than 10 feet to any building wall unless the wall and any interior openings within 10 feet have a 3-hour fire protection rating.

- K. Pad Installation Inspection: Phone Stan Krohn, at 615-0619, 48 hours in advance of setting the pad in order to schedule a field engineer to observe the setting. No inspection will be made unless the shoring for the vault excavation complies with WAC296-155 Part N. >Excavation, Trenching and Shoring=.
- L. Pad: Provide and install 93" x 96" prefabricated or cast in place pad. Locate and install as indicated on the marked plan. Observe specifications detailed in City Light Construction Guideline U10-1.6.
- M. Ground Rods: Provide and install two 5/8" x 8' copper-clad, set in opposite corners.
- N. Ground Mat: Number 2/0 AWG, bare, copper, per Construction Guideline U10-1.6.
- O. Access: Provide adequate City Light vehicular (truck) access to the padmount at all time for installation and service of electrical equipment.
- P. Guard Posts: Provide and install two 4" x 8' rigid steel inserted to a depth of four feet and filled with concrete before the transformer is installed. Check with the job crew chief for exact location.
- Q. Primary Conduit, Straight
  - 1. Install the conduit as shown in Construction Guideline U2-1.4.
  - 2. Provide and install two 4-inch, PVC Schedule 40 conduits.
- R. Primary Conduit, Sweeps: A maximum of 180 degree of bends are allowed and shall be rigid galvanized steel with a minimum radius of 3'.
- S. Secondary Conductors: Code sized in code-sized conduit. Leave a minimum of six feet extending into the transformer secondary compartment. The maximum sized cable shall be 750 MCM and limited to four cables per phase and neutral.
- T. Conduit Depth: Observe specifications detailed in City Light Construction Guideline U2-10. The conduits must be inspected by the Electric Service Consultant before covering.
- U. Conduit, Cleaning: clean, mandrel the conduit, install a pulling handline and a marking tape according to City Light Construction Guideline U2-11.4.4.

V. Metering:

1. Install metering equipment according to City Light's Requirements for Electric Service Connection= manual, Section 10, Meters.
2. Meet City Light accepted Electric Utility Service Equipment Requirements Committee(EUSERC) standards.

W. Charges

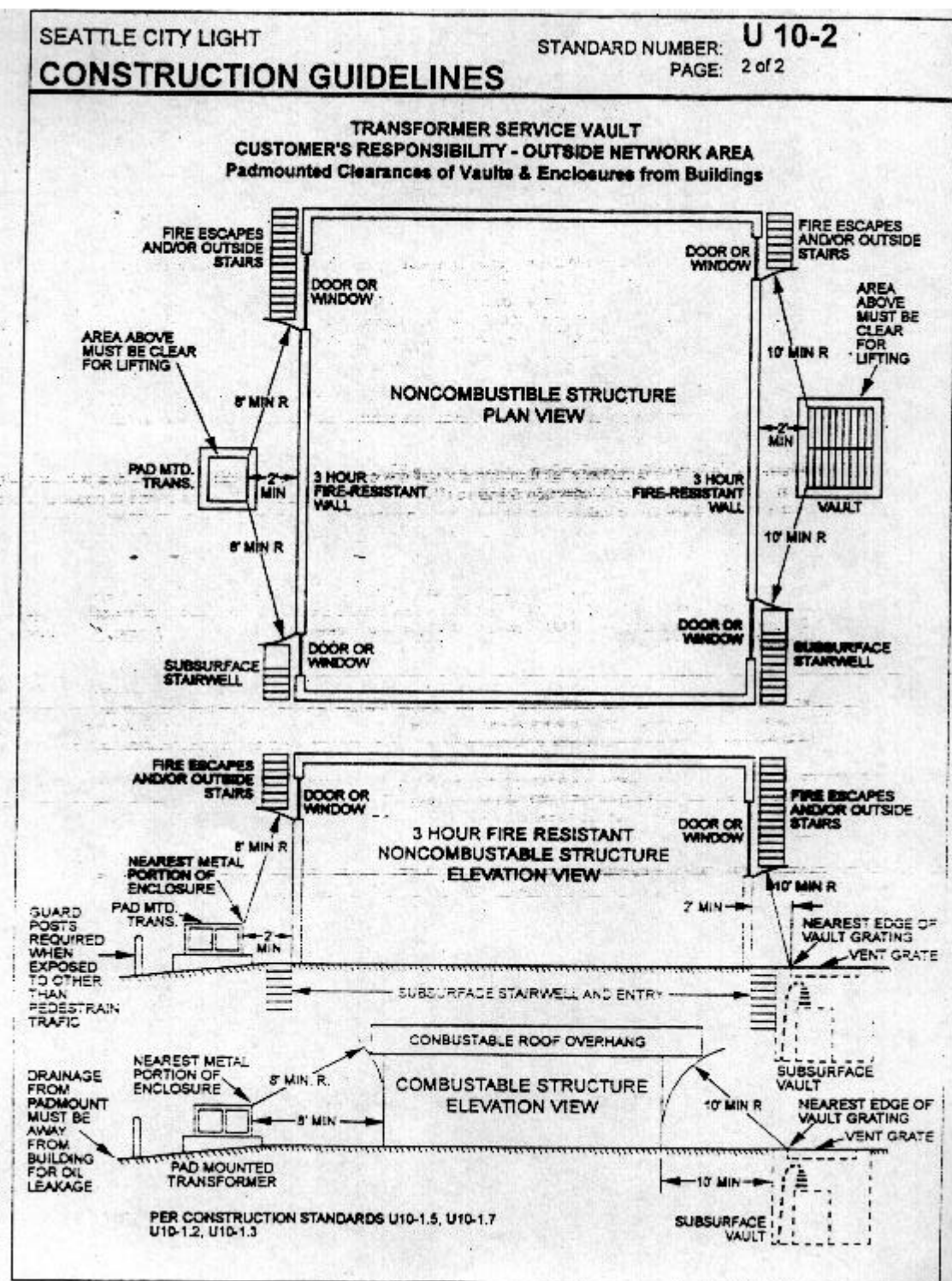
1. Pay City Light an installation charge for the actual time and material costs associated with this project. City Light will perform the installation work unless the customer chooses to request our permission to have a licensed private contractor of their choice do the work and the Utility approves their plans. A written request from the customer is required within 30 days after the date of the contract application. If the request is not received within that time, City Light will assume responsibility for installing the service and the customer shall pay the appropriate charge.
2. If a private contractor is approved to do the installation, the Utility still must perform and charge for certain tasks like meter installation, final connections, certain inspections, and engineering work.
3. City Light will estimate their cost of the work if they complete the installation is. An initial payment is required before City Light will begin work. A total of 90 percent must be paid before the service will be approved for connection. A final billing will be rendered to adjust for the actual time and the material when the job is completed.
4. All charges are in effect for 120 days (calendar). The charges are subject to review after the 120 day period has expired. Also, any change in the design of the project will subject the charges to a review.

- X. Schedules for completing installation may vary depending on the option selected. Large projects may require up to 18 months lead time to allow us to procure the equipment and materials required. Any changes to the contract application terms must be made well before your estimated connection date if delays are to be avoided.

Y. For a City Light-installed service, City Light will:

1. Install primary cable from the primary pulling vault to the pad.
2. Provide and install the required padmount transformer.
3. Make electrical connections to the customer=s cables at the padmount transformer and all primary electrical connections.
4. Install metering.

Z. The following detail and standards sheets form a part of this specification.





SEATTLE CITY LIGHT		STANDARD NUMBER: U 10-2	
CONSTRUCTION GUIDELINES		PAGE: 1 of 2	DATE: Sept 21, 1983
		REV: April 25, 1996	
<b>TRANSFORMER SERVICE VAULT CUSTOMER'S RESPONSIBILITY - OUTSIDE NETWORK AREA</b>			
<p>1. <b>Requirements and Codes:</b> When the customer is required to furnish a transformer vault, as required in "Requirements for Electrical Service Connection and Electrical Rate Ordinance," the vault shall be constructed and vented in accordance with the National Electric Code, Article 450, and the Seattle Building Code, 1994 Edition, Section 414 and Appendix to Chapter 4, Section 436. The vault location shall conform to Washington Administrative Code 296 46-480 "Washington State Laws, Rules and Regulations for Installing Electric Wires and Equipment". The vault size, ventilation, access and grounding shall be approved by City Light.</p> <p>2. <b>Vault Lighting:</b> For vaults within a building, the customer shall install lights and receptacles per Construction Standard U10-6. For below grade vaults outside buildings, lights and receptacles shall be installed by the customer only when designated by City Light.</p> <p>3. <b>Primary Conduit:</b> The customer shall furnish and install one conduit from the vault floor or wall to a point one conduit length up the utility pole per Construction Standard U7-10.2. When the designated pole is on the opposite side of the street, the conduit shall be installed from the vault to the property line, or to a point in the right-of-way beyond obstructions. The conduit size and location shall be designated by City Light. Conduit beneath a building floor slab shall be rigid galvanized steel.</p> <p>4. <b>Secondary Bus Duct:</b> If the customer installs bus duct, it shall extend approximately 18" into the vault. The conduit location shall be designated by City Light. The customer shall drill the bus for the number of connectors designated by City Light. The holes shall have NEMA spacing, 1-3/4" center to center, for 1/2" bolts (5/16" holes). The connectors will be furnished by City Light.</p> <p>5. <b>Secondary with Conduit and Cable:</b> If the customer installs conduit instead of bus duct, the customer shall furnish and install phase and neutral conductors of sufficient length to connect to the transformer terminals. If more than four conductors per phase and neutral are installed, the customer may be required to provide a suitable tap box or collector bus in the vault with compression-type connectors on the bus of the size, type and number designated by City Light.</p> <p>6. <b>Ground Rods:</b> The customer shall furnish and install two 5/8" x 8' copperclad steel occasional ground rods in opposite corners of the vault. The rods shall protrude approximately 6" above the finished floor. A driving head shall be used to prevent damage to the ground rod threads. The space between the rods and the floor shall be caulked and grouted to prevent the entrance of water.</p> <p>Occasionally, due to poor ground conditions on very large transformers, multiple transformer installations, or high fault duties, the customer will be required to install more ground rods as designated by City Light.</p> <p>Where vaults are on upper floors, four ground rods shall be driven below ground level eight feet apart. A ground wire shall be connected to the ground rods and run into the vault and affixed to three walls of the vault approximately 18" above the floor. The size of the wire shall be determined by the National Electric Code and shall be of adequate size to carry the available fault current.</p> <p>7. <b>Vault Lock:</b> The customer shall furnish and install either (a) a heavy duty hasp for a padlock or (b) a mortise-type lock that will accept a Best Universal Lock Company core.</p> <p>8. <b>Sump pump Discharge:</b> For below grade vaults, the customer shall furnish and install one 2" PVC, Schedule 40, pipe through the ceiling or high through the wall and into the nearest storm drain. The pipe shall extend a minimum of 4" into the vault.</p>			
ORIGINATOR	STANDARDS COORDINATOR	STANDARDS SUPERVISOR	UNIT DIRECTOR
<i>James D. Horn</i>	<i>Charles L. Shaffer</i>	<i>John A. Kinnaman</i>	<i>Betty Robm</i>

SEATTLE CITY LIGHT  
**CONSTRUCTION GUIDELINE**

STANDARD  
NUMBER: **U12-1.4/NDK-60**  
PAGE: 1 of 1  
DATE: February 1, 1977  
REV: June 4, 1996

**INSTALLATION DETAILS FOR UNDERGROUND SERVICES-  
NON METALLIC AND RIGID STEEL CONDUIT ON PRIVATE PROPERTY**

**General**

1. No definite separation is required between power, telephone and CATV cables although 8" to 12" is advisable.
2. All direct burial cables, nonmetallic and rigid steel conduit for lateral service to private property from the distribution trench shall be 3' below final grade in the public right-of-way. All rules for material types, trench finish and backfill shall be as noted below

**A. Non-Metallic Conduit on Private Property**

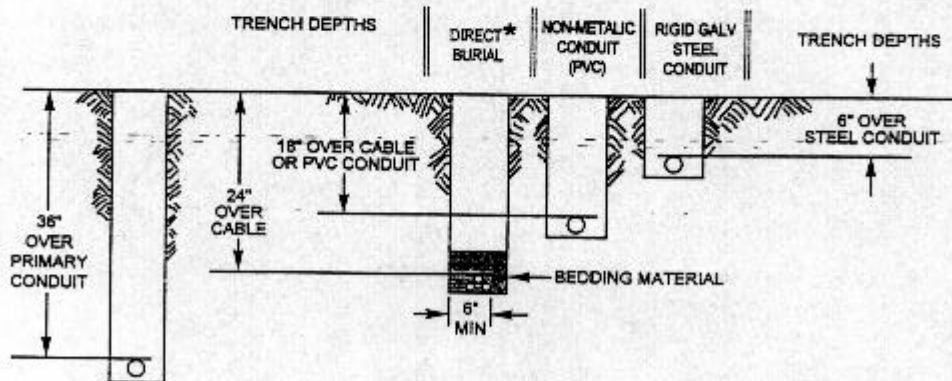
1. Depth shall be 18" over non-metallic conduit. (36 inches for High Voltage Conduit)
2. Conduit shall be PVC schedule 40 or other non-metallic conduit approved for direct burial.
3. The bottom of the trench and backfill shall be free of debris, large rocks (2"+), paving material, cinders, large or sharply angular objects, solvents or corrosive materials that may damage conduit, cable or prevent adequate compactions of backfill.

**B. Rigid Steel Conduit on Private Property**

1. Depth shall be 6" over rigid steel conduit. (36 inches for high voltage conduit)
2. Conduit shall be rigid galvanized steel.
3. The bottom of the trench and backfill shall be free of debris, large rocks (2"+), paving material, cinders, large or sharply angular objects or corrosive materials that may damage the conduit, cable or prevent adequate compaction of backfill.

**C. Direct Burial Cables on Private Property (Not Allowed for New Permanent Construction)**

**TRENCHING DEPTHS FOR PRIVATE PROPERTY**



**NOTES**

- A. SEE CONSTRUCTION STANDARD U2-10 FOR TRENCHING IN R/W  
\*NOT ALLOWED FOR NEW PERMANENT CONSTRUCTION

ORIGINATOR	STANDARDS COORDINATOR	STANDARDS SUPERVISOR	UNIT DIRECTOR
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SEATTLE CITY LIGHT  
**CONSTRUCTION GUIDELINE**

STANDARD  
NUMBER: **U 2 - 11.4.4/NDK-40**  
PAGE: 1 of 1  
DATE: December 12, 1962  
REV: June 23, 1998

**MANDRELING & CLEANING  
OF DUCTS AND CONDUIT**

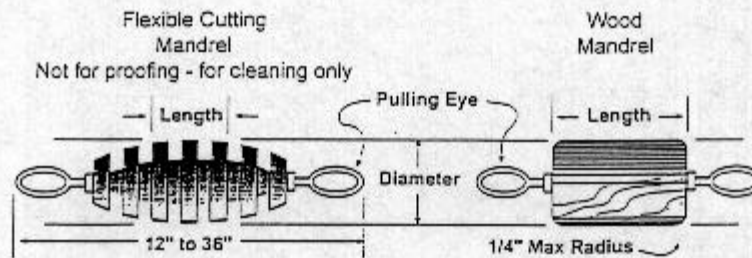
After the concrete has been poured or the trench backfilled over conduit each and every duct run and conduit shall be tested for obstructions or flattening by pulling a non-flexible wood mandrel of appropriate size through the duct or conduit within 5 days of installation. If an obstruction is found in a duct or conduit, that section shall be replaced.

Cleaning ducts shall be performed by drawing a brush with stiff bristles and a swab through each duct and conduit to make certain no foreign materials are left in the duct.

Cleaning and mandreling operations may be performed simultaneously.

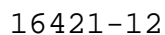
After cleaning and mandreling, each conduit shall have a pull line left in it. One of the conduits in each duct bank, and every conduit not part of a duct bank, shall contain a detectable underground marking tape, red-colored, LineTec Type A or equal (City Light Stock No. 736800).

Conduit Size Inches	Mandrel Sizes	Mandrel Length Inches
	Mandrel Diameter Inches	
3/4	0.62	1.00
1	0.78	1.25
1-1/4	1.00	1.50
1-1/2	1.25	1.75
2	1.62	2.25
2-1/2	2.00	2.75
3	2.50	3.25
3-1/2	3.00	3.75
4	3.50	4.25
5	4.75	5.25
6	5.50	6.25



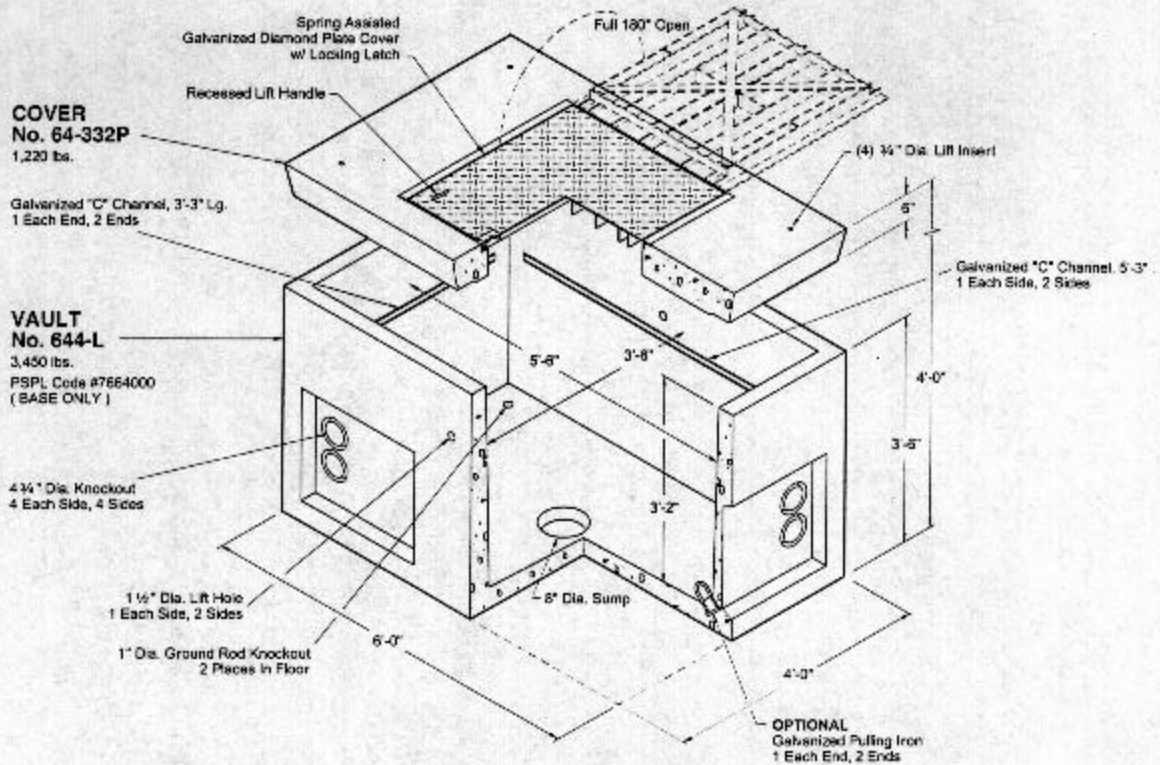
**Typical Mandrel Configuration**

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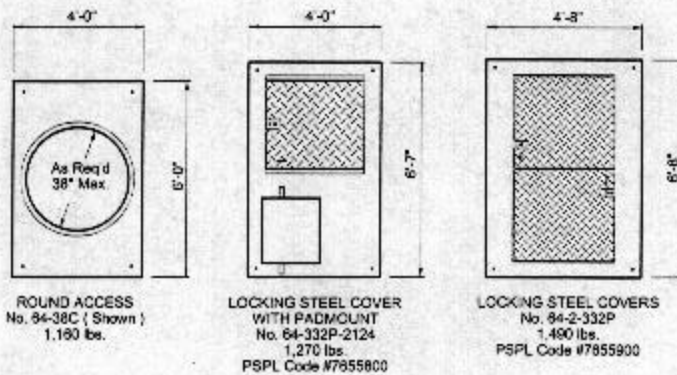




## 644-LA



### OPTIONAL COVER SECTIONS



**UTILITY VAULT COMPANY**

P.O. BOX 588 Phone: 206-339-3500  
Auburn, Washington 98071-0588 Fax: 206-335-4201

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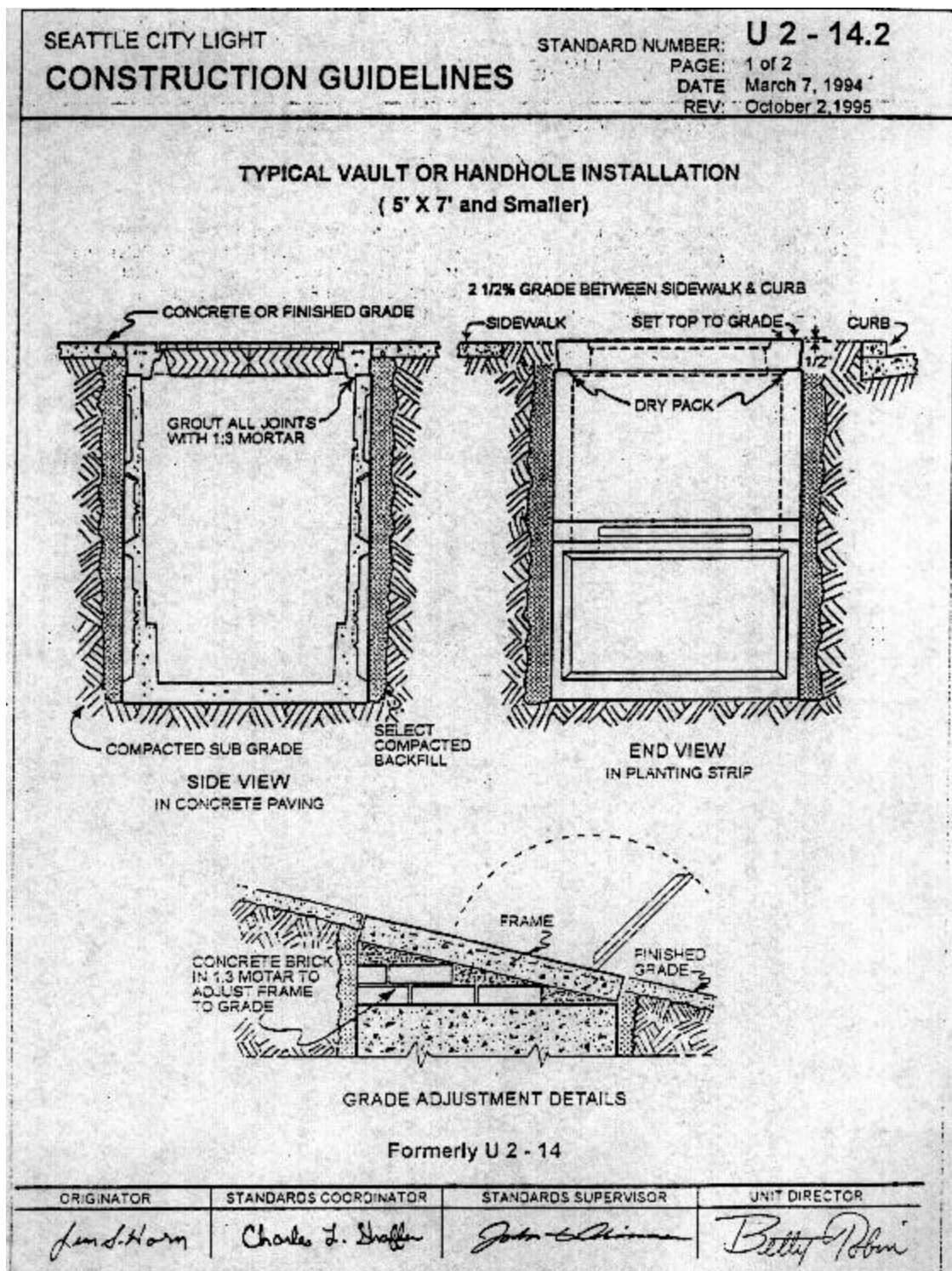
19

For Vault Extensions, See RISER Section.  
For Details Of Access Covers, See COVER Section.

\* ITEMS SHOWN ARE SUBJECT TO CHANGE WITHOUT NOTICE.

**FOR DETAILS SEE REVERSE SIDE.**

Issue: January, 1996



SEATTLE CITY LIGHT  
CONSTRUCTION GUIDELINES

STANDARD NUMBER: **U 2 - 14.2**  
PAGE: 2 of 2

**TYPICAL VAULT OR HANDHOLE INSTALLATION**  
**( 5' X 7' and Smaller)**

**NOTES**

1. All work, including shoring and bracing, shall meet all requirements of Washington State (WISHA) "Safety Standards for Construction Work"; WAC 296-46-480 "Washington State Laws, Rules and Regulations for Installing Electric Wires and Equipment", vault requirements under jurisdiction of Chapter 55, Seattle Building Code; and the latest Seattle Board of Public Works requirements, "Street and Sidewalk Pavement Openings and Restoration Rules", December 1993.
2. Concrete shall be Class 5.5 as specified in "City of Seattle Standard Plans and Specifications". Trowel smooth.
3. Drypack all holes tight after installation.
4. On sloping grade installations, hinge vault covers as noted. Hinged vault hatches shall be placed so that they lie flat when opened.
5. Use no more than 8" of brick and mortar. If more than 6" is necessary to bring the vault cover to grade, order a sloping riser from one of the approved vault suppliers. Order a length of strut cast into the side of the riser if it is 12" or more deep.
6. The divider, when used, must come up tight to the vault cover. Brick up as necessary, or if over 6" of increase is required, order a special divider.
7. For transformer and J-Box combinations in the 577 vault, install rigid steel conduit through the transformer section of the vault as shown on page 1 of U9-5.
8. The preferred vault orientation for combination transformer and J-Box in the 577 vault is the length of the vault perpendicular to the curb. See U2-14.1, page 1.
9. The length of the grated vent slots must run perpendicular to the dominant direction of travel of sidewalk traffic.
10. Two 8 foot by 5/8 inch diameter copper clad steel ground rods shall be installed in opposite corners of each vault.
11. Engineers shall specify conduit entrance locations into vault on work order. Contractors/installers shall verify before installation.

**REFERENCES**

1. U2-14.1 Residential Equipment Location Details
2. U9-5 577 Vault - Transformer & J-Box Installation, Grounding & Connections
3. U9-6 577 Vault with 3 L. B. Junction Boxes, Installation, Grounding & Connections
4. U2-13.1 Typical Handhole With Conduit Installation Details

Formerly U2-14

END OF SECTION





SECTION 16441

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fusible Disconnect switches.
- B. Nonfusible Disconnect switches.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16170 - Grounding and Bonding
- C. Section 16180 - Equipment Wiring Systems
- D. Section 16190 - Supporting Devices
- E. Section 16191 - Seismic Restraint Systems
- F. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

- A. NEMA ICS6 - Enclosure for Industrial Controls Systems
- B. NEMA KS 1 - Enclosed Switches.
- C. NFPA 70 - National Electrical Code.
- D. NECA - Standard for Installation.

1.4 SUBMITTALS: Submit under provisions of Sections in divisions 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each different disconnect switch. The information shall be in the form of the manufacturer's standard data sheets.

- 1. Voltage rating
- 2. Ampere rating
- 3. Horsepower rating
- 4. Number of poles

5. Switch and contact materials
6. Fuseclips
7. Fuse type and ratings
8. Handle; interlock and padlocking provisions.
9. Enclosure type
10. Enclosure material and finish.
11. Dimensioned picture or drawing of the switch.

- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the switch.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Record actual location, size of the disconnect switch and the circuit to which it is connected.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Submittal data sheets.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standards listed in Section 16010.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

## 1.10 FIELD MEASUREMENTS

- A. The locations of disconnect switches indicated on the drawings are approximate. Coordinate the exact location with equipment, etc. so that access and proper clearances are maintained.

## 1.11 EXTRA MATERIALS

- A. Furnish under provisions of Sections in divisions 0 and 1.
- B. Provide three of each size and type of fuses installed.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. General Electric
- B. Siemens ITE
- C. Square D
- D. Westinghouse
- E. Approved equal under provisions of Sections in divisions 0 and 1.

### 2.2 ENCLOSED SWITCHES

- A. Fusible Switch Assemblies: 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions. Fuse clips: Positive pressure reinforced designed to accommodate Class R fuses.

- B. Nonfusible Switch Assemblies: 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions.
- C. Ratings: The number of poles, switch ampere rating and fuse ampere rating shall be as indicated.
- D. Fuses: UL Class RK1 unless otherwise indicated. Refer to Section 16477 - Fuses.
- E. Enclosures: Surface mounted, code gauge steel with manufacturer's standard gray enamel finish.
  - 1. Interior Dry Locations: NEMA Type 1.
  - 2. Exterior Locations: NEMA Type 3R.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install disconnect switches level and plumb.
- B. Install fuses in fusible disconnect switches.
- C. Provide proper anchors and supports. Refer to Section 16190 and 16191.
- D. Identify each disconnect switch, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/4" (6 mm) minimum high white characters.

END OF SECTION

SECTION 16461

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Dry type two winding transformers.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical.
- B. Section 16170 - Grounding and Bonding.
- C. Section 16190 - Supporting Devices.
- D. Section 16191 - Seismic Restraint Systems.

1.3 REFERENCES

- A. NEMA ST 20 - Dry Type Transformers for General Applications.
- B. NFPA 70 - National Electrical Code.
- C. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each transformer. The information shall be in the form of the manufacturer's standard data sheets or drawings.
  - 1. KVA rating
  - 2. Voltage ratings
  - 3. Winding configuration and taps
  - 4. Temperature rise rating
  - 5. Insulation type and rating
  - 6. Impedance
  - 7. Noise level

- 8. Weight
- 9. Cabinet material
- 10. Finish
- 11. Dimensioned picture or drawing
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation, of the transformer.
- 1.5 PROJECT DOCUMENTS
  - A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Record the actual location and size to scale of transformers on the drawings.
- 1.6 OPERATION AND MAINTENANCE DATA
  - A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Maintenance data: Submittal data sheets.
- 1.7 QUALITY ASSURANCE
  - A. Perform Work in accordance with codes and standards listed in Section 16010.
- 1.8 QUALIFICATIONS
  - A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- 1.9 REGULATORY REQUIREMENTS
  - A. Conform to requirements of NFPA 70.
  - B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect, and handle products to site under provisions of Sections in division 0 and 1.
- B. Deliver transformers individually wrapped for protection and mounted on shipping skids.
- C. Accept transformers on site. Inspect for damage.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

#### PART 2 PRODUCTS

##### 2.1 TWO-WINDING TRANSFORMERS

- A. Manufacturers:
  - 1. General Electric
  - 2. Siemens ITE
  - 3. Square D
  - 4. Westinghouse
  - 5. Approved equal under provisions of Sections in division 0 and 1.
- B. Description: factory-assembled, air cooled dry type transformers, two-winding type, single or 3-phase, as indicated with one coil per phase in primary and secondary; ratings as indicated. 3-phase transformers shall be connected delta on the primary and wye connected on the secondary.
- C. Cores: Grain-oriented, nonaging silicon steel.
- D. Insulation system and average winding temperature rise for rated KVA as follows:

1. 15 KVA or Less: Class 185 or 220 with 115 degrees C rise.
  2. Larger than 15 KVA: Class 220 with 115 degrees C rise.
- E. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point.
- F. Winding Taps:
1. Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
  2. Transformers 15 KVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below rated voltage.
- G. Sound Levels:
- |              |       |
|--------------|-------|
| 0 - 9 KVA:   | 40 dB |
| 10-50 KVA:   | 45 dB |
| 51-150 KVA:  | 50 dB |
| 151-300 KVA: | 55 dB |
| 301-500 KVA: | 60 dB |
- H. Basic Impulse Level: 10 KV for transformers less than 300 KVA, 30 KV for transformers 300 KVA and larger.
- I. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- J. Mounting: 15 KVA and smaller - floor or wall mounted; above 15 KVA - floor mounted.
- K. Coil Conductors: Copper continuous windings without splices except for taps with terminations brazed, welded or pressure type.
- L. Enclosure: Code gauge steel; NEMA Type 1, ventilated or totally enclosed nonventilated as indicated. Provide lifting eyes or brackets. Finish shall be manufacturer's standard gray enamel.
- M. Isolate core and coil from enclosure using neoprene vibration-absorbing mounts.
- N. Fungus Proofing: Permanent fungicidal treatment for coil and core.



## 2.2 SOURCE QUALITY CONTROL

- A. Provide production testing of each unit in accordance with NEMA ST20.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are suitable for installing transformer supports.

### 3.2 PREPARATION

- A. Provide concrete pad under provisions of Section 16010.

### 3.3 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Set transformer plumb and level.
- C. Use flexible conduit, under the provisions of Section 16111, 2 ft (0.6 M) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- D. Mount transformers on neoprene vibration isolating pads suitable for isolating the transformer noise from the building structure.
- E. Provide seismic restraints as per Section 16191.
- F. Provide grounding and bonding in accordance with Section 16170 and as indicated.
- G. Identification: Identify each transformer with a laminated plastic nameplate engraved with 1/2 inch (13 mm) minimum height characters showing the designation indicated on the drawings, the circuit number and device size from which it is fed and the primary feeder size. The nameplate shall be black with white characters and secured to the front of the transformer.

### 3.4 FIELD QUALITY CONTROL

- A. Check for damage and tight connections prior to energizing transformer.

- B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

## SECTION 16470

### PANELBOARDS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Service and distribution panelboards.
- B. Lighting and Appliance Branch circuit panelboards (hereafter referred to as branch circuit panelboards).

##### 1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical.
- B. Section 16190 - Supporting Devices.
- C. Section 16195 - Electrical Identification.
- D. Section 16477 - Fuses.

##### 1.3 CODES AND STANDARDS

- A. NECA (National Electrical Contractors Association) "Standard of Installation".
- B. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
- C. NEMA FU 1 - Low Voltage Cartridge Fuses
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NEMA PB2.2 - Application Guide for Ground Fault Protective Devices for Equipment.
- H. NFPA 70 - National Electrical Code.
- I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- J. UL 50 - Cabinets and Boxes
- K. UL 67 - Panelboards

- L. UL 98 - Enclosed and Dead-Front Switches
- M. UL 198C - High-Interrupting-Capacity Fuses, Current-Limiting Types
- N. UL 198D - High-Interrupting-Capacity Fuses, Class K fuses.
- O. UL 198E - Class R Fuses
- P. UL 198G - Fuses for Supplementary Overcurrent Protection
- Q. UL 486A-80-Wire Connectors And Soldering Lugs For Use With Copper Conductors.
- R. UL 489 - Molded-Case Circuit Breakers and Circuit - Breaker Enclosures.
- S. UL 512 - Fuseholders
- T. UL 869A - Service Equipment
- U. UL 1053-88 - Ground-Fault Sensing and Relaying Equipment.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each panelboard. The information may be in the form of schedules, and/or manufactures standard drawings. The manufacturers standard drawings shall indicate, by panel designation, the panelboard for which they apply.
  - 1. Panelboard designation from the construction drawings.
  - 2. Manufacturer's series or catalog number.
  - 3. Enclosure NEMA rating (1, 3R, etc.)
  - 4. Metal gage for backbox, dead-front and trim.
  - 5. Enclosure mounting type (flush, surface, etc.)
  - 6. Backbox and panel interior mounting provisions.
  - 7. Front and/or rear accessibility.

8. Enclosure dimensions (height, width, depth)
  9. Trim type (flush, with door; surface, without door; etc.) and the method for securing trim to the panel.
  10. Type of door latch, lock and hinges.
  11. Finish of the panel, deadfront and trim.
  12. Top or bottom feed.
  13. Gutter sizes.
  14. Removable end panels (blank or with knockouts)
  15. Voltage rating
  16. Number of phases and phasing diagram.
  17. Neutral bus (if required)
  18. Equipment ground bus
  19. Isolated ground bus (if required)
  20. Frequency
  21. Material and ampere rating of main lugs, and phase, neutral and ground busses.
  22. Bus insulation and isolation material.
  23. Designation, quantity, voltage, load and fault current ampere ratings for overcurrent devices including spares.
  24. Termination temperature ratings of lugs and overcurrent devices.
  25. Settings for adjustable circuit breakers.
  26. Fuse sizes and designations (U.L. class)
  27. Number of provisions including circuit breaker frame sizes, fused switch sizes and poles.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for

storage, handling, protection, examination, preparation, installation, and start-up of the panelboards.

1.1 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Record actual locations of panelboards; indicate actual branch circuit arrangement on panelboard schedule.
- C. Refer to Section 16010.

1.2 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in division 0 and 1.
- B. Maintenance Data: Include spare parts data listing; source of replacement parts and supplies; and recommended maintenance procedures and intervals.
- C. Refer to Section 16010.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in Section 16010.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL label.

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

1.7 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Sections in division 0 and 1.

- B. Provide two panelboard keys.
- C. Provide two fuse pullers.
- D. Obtain a signed receipt from the user's representative for all materials provided.

#### 1.8 EXTRA MATERIALS

- A. Furnish under provisions of Sections in division 0 and 1.
- B. Provide three of each different size and type of fuse.
- C. Provide three of each different size and type of single pole circuit breaker and one of each different size and type of two and three pole circuit breakers.
- D. Obtain a signed receipt from the user's representative for all materials provided.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. G.E.
- B. Square D
- C. Westinghouse
- D. Siemens
- E. Approved equal under provisions of Sections in division 0 and 1.

#### 2.9 MAIN DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, dead-front circuit breaker type, or fused switch type as indicated for 600 volts or less, 100 - 1200 amps and group mounted devices. Load centers are not acceptable.
- B. Panelboard Buses: Provide tin plated copper phase buses, connector fingers and neutral buses of 98 percent conductivity, and ratings as indicated. Provide a separate copper equipment ground bus, bonded to the cabinet, in each panelboard. Provide a separate copper isolated ground bus, insulated from the cabinet where indicated. Phase buses shall be one continuous bar per

phase, factory assembled and provide sequentially phased branch distribution. Phase buses shall be separated and rigidly supported by insulating material rated for the applicable voltage, amperage and fault currents. The neutral bus shall have the same ampere rating as the phase buses or 200 percent of the phase buses where indicated. Provide a neutral bonding strap for panels rated for service equipment. Neutral and ground buses shall have a separate lug for each wire connection. All buses shall be labeled or identified as to their purpose.

- C. Cable Connections: Cable connection lugs shall be copper alloy, compression solderless lugs rated for the type and temperature rating of the wire used.
- D. Main Devices: These shall be main lugs, fused switch or circuit breaker as indicated.
- E. Minimum integrated short circuit rating: As indicated.
- F. Device Mounting: Circuit breakers and fused switches shall be capable of being removed or installed without disturbing adjacent devices.
- G. Provisions for Future Devices: Provisions for future fused switches and circuit breakers shall be equipped with hardware and busses to accept the size switch or breaker indicated.
- H. Enclosure: NEMA PB 1, Type 1,3R or 12; flush or surface mounted as indicated.
- I. NEMA 1 Enclosure: Backbox shall be galvanized, code thickness, steel with removable end walls, adjustable panel interior mounting studs or brackets and provisions for mounting the panel deadfront and trim. End walls may or may not have knockouts for conduits. Backboxes shall be sized to provide wiring gutter space per the N.E.C. and U.L. standards. The backbox shall have a separate UL label from the panelboard. The backbox shall be provided by the same manufacturer as the panelboard.

Branch circuit and distribution panelboards shall have dead-front trims of code thickness, secured to the panel interior with screws. The dead-front for circuit breaker panels shall have twist out, or snap-in fillers or plates secured with screws for device provisions. The dead-front for fused switch panels shall have metal plates secured with screws for provisions. All flush mounted branch circuit and distribution panelboards shall have one piece



flush trims which overlap the backbox a minimum 3/4" (19 mm) on all sides with hinged doors and trim clamps for adjusting. Surface mounted branch circuit panelboards shall have one piece surface trims, which is the same size as the backbox with hinged doors and trim clamps for adjusting. Surface mounted distribution panels shall have one or four piece surface trims which is the same size as the backbox without hinged doors and secured with screws.

Doors in flush or surface mounted branch circuit panel trims and flush mounted distribution panel trims shall have concealed hinges, and flush mounted latch and cylinder lock. Doors in surface mounted distribution panel trims shall have flush mounted latch or handle and flush mounted cylinder lock and may have exposed hinges. Doors over 48 inches high shall have three point latching.

All locks shall be keyed alike. Doors shall have a metal directory card frame with a circuit directory card and clear plastic cover mounted on the inside face.

Dead-fronts and flush and surface trims shall be phosphatized steel and finished in the manufacturer's standard baked or electrodeposited gray enamel or lacquer finish unless otherwise indicated.

J. Panelboards Used as Service Equipment: Where panelboards are used as service equipment, they shall be U.L. Listed as "Suitable for Use as Service Equipment" and bear the U.L. label.

K. All panelboards shall be of the same manufacturer.

## 2.10 CIRCUIT BREAKERS

A. Circuit breakers shall be as specified and of the types as listed below.

B. Circuit breakers shall have voltage, current, pole and interrupting ratings as indicated. Circuit breakers shall be fully rated.

C. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, automatic, integral thermal and instantaneous magnetic trip in each pole, with common trip handle for all poles. Single pole breakers with field installed handle ties are not acceptable. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupted circuit breakers where schedule. Provide circuit breakers UL listed as Type HACR for air

conditioning equipment branch circuits. Do not use tandem circuit breakers.

- D. Current Limiting Molded Case Circuit Breakers: NEMA AB 1, bolt-on type circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- E. Electronic Molded Case Circuit Breakers: NEMA AB1, bolt-on type with integral microprocessor based trip system, current rating plugs and adjustment panel.
- F. Provide circuit breaker accessory trip units and auxiliary switches as indicated.

## 2.11 FUNGUS PROOFING

- A. Provide permanent fungicidal treatment for panelboards including circuit breakers and fused switches and other components.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards in accordance with manufacturer's requirements.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 16190.
- C. Panelboards shall not be supported by branch circuit or feeder conduits.
- D. Provide one required size bolt in each mounting hole in the backbox.
- E. Mounting Height: 6'-6" (2 m - 150 mm) above the finished floor to top of panelboard; install panelboards taller than 6'-6" (2 m - 150 mm) such that the operating handle of the top devices is no more than 6'-6" (2 m - 150 mm) above the finished floor.
- F. Provide filler plugs for unused conduit openings in panelboards.

- G. Provide spare conduits out of each recessed branch circuit and distribution panelboard up to the nearest accessible ceiling space. Provide one 1/2 inch ( 13 mm) conduit for every three spare single pole breakers or provisions. Provide one conduit for each two and three pole spare breaker or switch or provision. The conduit size shall be based on a four wire circuit for two pole breakers and switches and on a five wire circuit for three pole breakers and switches and on the corresponding phase, neutral and equipment grounding conductor for the spare or provision breaker frame or switch size. Spare conduits shall be capped. Spare conduits may not be provided for surface mounted panelboards unless otherwise indicated.
- H. Train conductors, in panel gutters, neatly in groups, bundle, and wrap with wire ties.
- I. Do not install panelboards under piping or ductwork.
- J. Identification
  - 1. Identification of Circuits and Equipment:  
Identification designations shall correspond to those indicated on the electrical drawings.
  - 2. Each overcurrent device in panelboards with doors shall be permanently identified by circuit number on the dead-front with additional information on the directory card.  
  
Each overcurrent device in panelboards without doors shall be permanently identified by a laminated plastic nameplate engraved with 1/8 inch ( 3 mm) minimum height characters showing the circuit number, the load served by the device and the location of the load. The nameplate shall be white with black characters and securely attached to the dead-front or the hinged door for fused switches.
  - 3. Clearly typewrite on each panelboard directory card the designations of the fixtures, outlets and equipment served by each device in the panelboard reflecting as-built circuiting. Panelboard directory cards shall indicate actual assigned room numbers and not those indicated on the plans if different.
  - 4. Identify each entire panelboard assembly with a laminated plastic nameplate engraved with 1/2 inch (13 mm) minimum height characters showing panelboard designation. The nameplate shall be white with black

characters and securely attached to the outside front of the panel. Provide an additional separate laminated plastic sign of the same specifications which indicates the feeder size, circuit number, protective device size and origin from which it is fed and securely attach to the inside of panelboard door over directory card for panels with doors and on the outside of the trim for panels without doors.

5. Each panelboard shall have a metal nameplate with the panel voltage, phases, wire, ampere and frequency ratings stamped or engraved on the plate. The manufacturer's name, model number, etc. and the UL label shall also be permanently printed on the plate. The plate shall be attached to the deadfront of the panelboard.

### 3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Sections in division 0 and 1.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for lugs, circuit breakers, fusible switches and fuses. Exercise all devices for proper operation. Touch-up all scratches in the finish with manufacturer's approved touch-up paint. Check all labeling for compliance with the specifications. Check for piping or ductwork that may have been installed over the panelboard after installation.

END OF SECTION

SECTION 16476

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Enclosed circuit breakers.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16170 - Grounding and Bonding
- C. Section 16180 - Equipment Wiring Systems
- D. Section 16190 - Supporting Devices
- E. Section 16191 - Seismic Restraint Systems
- F. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

- A. NECA (National Electrical Contractors Association)  
"Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers
- C. NFPA 70 - National Electrical Code.
- D. UL 489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.

1.4 SUBMITTALS: Submit under provisions of Sections in division 0 and 1. Refer to Section 16010.

- A. Data Sheets: Submit as a minimum the following information on each enclosed circuit breaker. The information shall be in the form of manufacturer's standard data sheets.

- 1. Manufacturer's series or catalog number.
- 2. Enclosure NEMA rating (1, 3R, etc.)
- 3. Metal gage for enclosure.
- 4. Enclosure mounting type (flush, surface, etc.)

5. Enclosure dimensions (height, width, depth)
  6. Finish of the enclosure.
  7. Neutral bus (if required).
  8. Equipment ground bus.
  9. Isolated ground bus (if required).
  10. Designation, voltage, load and fault current ampere ratings for circuit breakers.
  11. Settings for adjustable circuit breakers.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the enclosed circuit breaker.
- 1.5 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Record actual locations of enclosed circuit breakers; indicate actual branch circuit.
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Submit under provisions of Sections in division 0 and 1.
  - B. Refer to Section 16010.
  - C. Maintenance Data: Submittal data sheets.
- 1.7 QUALITY ASSURANCE
- A. Perform Work in accordance with codes and standards listed in Section 16010.
- 1.8 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL Label.

## 1.10 FIELD MEASUREMENTS

- A. Locations of enclosed circuit breakers indicated on the drawings are approximate. Coordinate the exact location with equipment, etc. so that access and proper clearances are maintained.

## 1.11 EXTRA MATERIALS

- A. Furnish under provisions of Sections in division 0 and 1.
- B. Provide three of each size and type current limiter.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. General Electric
- B. Siemens ITE
- C. Square D
- D. Westinghouse
- E. Approved equal under provisions of Sections in division 0 and 1.

### 2.2 MOLDED CASE CIRCUIT BREAKER

- A. Circuit Breaker: NEMA AB 1.

### 2.3 TRIP UNITS

- A. Field-Adjustable Trip Circuit Breaker: Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time, short time, continuous current pickup setting for automatic operation.
- B. Field-Changeable Ampere Rating Circuit Breaker: Provide circuit breakers with frame sizes 200 amperes and larger with changeable trip units.

- C. Current Limiting Circuit Breaker: Provide circuit breaker as indicated with automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

## 2.4 PRODUCT OPTIONS AND FEATURES

- A. Provide accessories as indicated.
- B. Shunt Trip Device: 120 volts, AC.
- C. Provide Products suitable for use as service entrance equipment where so indicated.

## 2.5 ENCLOSURE

- A. Enclosure: NEMA Type 1 or as indicated on drawings.
- B. Enclosure fabricated from code gauge steel.
- C. Finish shall be manufacturer's standard gray enamel finish.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 16190 and 16191.
- C. Height: 5 ft (1.6 M) to operating handle.
- D. Provide engraved plastic nameplates under the provisions of Section 16195. Identify each separately enclosed circuit breaker, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/2" (13 mm) high white characters.

## 3.2 FIELD QUALITY CONTROL

- A. Inspect each circuit breaker visually.



- B. Perform several mechanical ON-OFF operations on each circuit breaker.

### 3.3 ADJUSTING

- A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit as indicated.
- B. Adjust trip settings to provide adequate protection from overcurrent and fault currents as indicated.

END OF SECTION



SECTION 16481

ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manual motor starters.
- B. Magnetic motor starters.
- C. Combination magnetic motor starters.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical
- B. Section 16170 - Grounding and Bonding
- C. Section 16180 - Equipment Wiring Systems
- D. Section 16190 - Supporting Devices
- E. Section 16195 - Electrical Identification
- F. Section 16191 - Seismic Restraint Systems

1.3 CODES AND STANDARDS

- A. NFPA 70 - National Electrical Code.
- B. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- C. UL 508 - Industrial Control Equipment
- D. UL 198E - Class R Fuses.
- E. UL 468A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.
- F. NECA "Standard of Installation," published by National Electrical Contractors Association.
- G. NEMA AB 1 - Molded Case Circuit Breakers.
- H. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

- I. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
  - J. NEMA KS 1 - Enclosed Switches.
  - K. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)
- 1.4 SUBMITTALS: Submit under provisions of Sections in divisions 0 and 1. Refer to Section 16010.
- A. Data Sheets: Submit as a minimum the following information on each different motor controller. The information shall be in the form of the manufacturer's standard data sheets.
    - 1. Manufacturer's series or catalog number.
    - 2. Enclosure NEMA type, material, interlocks, finish, etc.
    - 3. Motor starter type
    - 4. Starter NEMA size
    - 5. Voltage rating
    - 6. Contact material
    - 7. Coil voltage
    - 8. Overload relay type and number
    - 9. Number, type and ratings of auxiliary contacts
    - 10. Types and ratings of pushbuttons, indicating lights and selector switches
    - 11. Types and ratings of auxiliary relays
    - 12. Disconnect type
    - 13. Frame or switch size
    - 14. Voltage and amperage ratings
    - 15. Fault current interrupting rating
    - 16. Fuse class, type and ratings
  - B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by

Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of the motor controller.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Record actual locations of motor controllers; indicate actual branch circuit.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standards listed in Section 16010.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the UL Label.

1.10 FIELD MEASUREMENTS

- A. The locations of enclosed motor controllers indicated on the drawings are approximate. Coordinate the exact location with equipment, etc., so that access and proper clearances are maintained.

### 1.11 EXTRA MATERIALS

- A. Furnish under provisions of Sections in divisions 0 and 1.
- B. Provide three of each size and type fuse installed.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. General Electric
- B. Siemens ITE
- C. Square D
- D. Westinghouse
- E. Approved equal under provisions of Sections in divisions 0 and 1.

### 2.2 MANUAL CONTROLLERS

- A. Manual Motor Controller: Single, double or three pole as indicated, AC general-purpose Class A manually operated, full-voltage controller with manual reset overload element, in each phase, red pilot light, auxiliary contact as indicated, and push button or toggle operator.
- B. Fractional Horsepower Manual Controller: single or double pole as indicated, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with manual reset thermal overload unit in each phase, red pilot light, and toggle operator.
- C. Motor Starting Switch: Single pole, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.
- D. Enclosure: NEMA; Type as indicated; flush or surface mounted as indicated.

### 2.3 AUTOMATIC CONTROLLERS

- A. Magnetic Motor Controllers: Across-the-line type, full voltage, non-reversing unless otherwise indicated, AC general-purpose Class A magnetic controller for induction

motors rated in horsepower. Contacts shall be copper with weld resistant silver cadmium oxide.

- B. Reversing Controllers: Include electrical interlock, integral time delay transition between FORWARD and REVERSE rotation and pushbuttons and pilot lights for each direction.
- C. Two Speed Controllers: Include integral time delay transition between FAST and SLOW speeds and pushbuttons and pilot lights for each speed.
- D. Coil operating voltage: Phase voltage if all controls are within the controller enclosure; 120 volts if control circuits extend outside of the controller enclosure.
- E. Overload Relay: Class 10; bimetal; manual reset; one overload in each phase; integral with controller.
- F. Control Voltage: Line voltage where all controls are within the controller enclosure; 120 volts ac where control devices are located outside of the controller enclosure.
- G. Enclosure: Code gauge steel; NEMA Type As indicated with locking provisions and manufacturer's standard gray enamel finish.

#### 2.4 PRODUCT OPTIONS AND FEATURES

- A. Auxiliary Contacts: 2 each normally open and closed contacts in addition to seal-in contact.
- B. Cover Mounted Pilot Devices: heavy duty oiltight type.
- C. Pilot Device Contacts: Form Z, rated A150.
- D. Pushbuttons: Shrouded momentary contact type.
- E. Indicating Lights: neon type.
- F. Selector Switches: Rotary type, 3 position, manual-off-automatic.
- G. Relays: Solid state phase loss relay to monitor voltage of all 3 phases.
- H. Control Power Transformers: 120 volt secondary, 50 va minimum, in each motor starter. Provide fused secondary, and bond unfused leg of secondary to enclosure.

## 2.5 DISCONNECTS

- A. Combination Controllers: Combine motor controllers with non-fusible switch or fusible switch disconnect as indicated in common enclosure. The cover of the enclosure shall be interlocked with the operating handle of the switch so that the cover cannot be opened unless the switch handle is in the off position.
- B. Nonfusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and locking provisions.
- B. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and locking provisions. Fuse clips: Designed to accommodate Class R fuses.

## 2.6 FUSES

- A. Description: Dual element, current limiting, time delay, one-time fuse, 250 or 600 volt as indicated, UL Class [RK 1] unless otherwise indicated.
- B. Interrupting Rating: 200,000 rms amperes.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed controllers plumb. Provide supports in accordance with Section 16190 and 16191.
- C. Height: 5 ft (1.6 M) to operating handle.
- D. Install fuses in fusible switches.
- E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- F. Install wiring in enclosures neatly trained.
- G. Provide engraved plastic nameplates under the provisions of Section 16195. Identify each magnetic motor starter, and manual motor starter, by attaching to the device cover a laminated plastic nameplate clearly and permanently lettered with the description and location of the equipment



controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with 1/4" (6 mm) high white characters.

### 3.2 FIELD QUALITY CONTROL

- A. Verify correct phasing and rotation of motors.
- B. Measure the voltage and amperage for each phase and verify that measurements are within motor nameplate ratings.

END OF SECTION



SECTION 16511

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior lighting fixtures and accessories.
- B. Exit signs.
- C. Ballasts.
- D. Fluorescent lamp emergency power supply.
- E. Lamps.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical.
- B. Section 16170 - Grounding and Bonding.
- C. Section 16190 - Supporting Device.
- D. Section 16191 - Seismic Restraint Systems.

1.3 CODES AND STANDARDS

- A. ANSI C78.1 to C78.1502 Standards for Various Types of Lamps.
- B. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
- C. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
- D. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).
- E. NFPA 70 - National Electrical Code.
- F. NFPA 101 - Life Safety Code.
- G. UL 924 - Emergency Lighting and Power Equipment.
- H. UL 935 - Fluorescent Lamp Ballasts.

- I. UL 1029 - High-Intensity Discharge Lamp Ballasts.
  - J. UL 1570 - Fluorescent Lighting Fixtures.
  - K. UL 1571 - Incandescent Lighting Fixtures.
  - L. UL 1572 - High-Intensity Discharge Lighting Fixtures.
  - M. UL 1574 - Track Lighting Systems.
- 1.4 SUBMITTALS: Submit under provisions of Sections in divisions 0 and 1. Refer to Section 16010.
- A. Data Sheets: Submit as a minimum the following information on each different fixture, ballast, lamp, exit sign, and emergency power unit. The information shall be in the form of the manufacturer's standard data sheets. Each lighting fixture data sheet shall indicate, by fixture type, the lighting fixture for which it applies.
- 1. Lighting Fixtures
    - a. Manufacturer's series or catalog number
    - b. Dimensioned picture or drawings
    - c. Material of housings, brackets, etc.
    - d. Finish
    - e. Ballast type
    - f. Lamp type
    - g. Voltage
    - h. Lens material, thickness and pattern
    - I. Louver or reflector material, depth, number of cells, and finish
    - j. Mounting hardware
    - k. Photometric and coefficient of utilization tables.
  - 2. Ballasts
    - a. Manufacturer's series or catalog number

- b. Ballast type
- c. Voltage
- d. Wattage
- e. Power factor
- f. Crest factor
- g. Harmonic factor

4. Exit Signs

- a. Manufacturer's series or catalog number
- b. Dimensioned picture or drawing
- c. Housing material and finish
- d. Lens material and character size
- e. Down light
- f. Battery type and rated life
- g. AC and DC voltage
- h. Charger type and charging modes
- I. Lamp type
- j. Test switch and indicator lights
- k. Control circuitry

5. Fluorescent Lamp Emergency Power Supply

- a. Manufacturer's series or catalog number
- b. Dimensioned picture or drawing
- c. Battery type and rated life
- d. AC and DC voltages
- e. Charger type and charging modes

- f. Test switch and indicator lights
    - g. Control circuitry
  - 6. Lamps
    - a. Manufacturer's series or catalog number
    - b. Picture or drawings
    - c. Lamp designation
    - d. Base or pin type
    - e. Voltage
    - f. Starting mode
    - g. Burning temperature
    - h. Color rendering index
    - I. Diffuser coatings and reflectors
  - B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.
  - C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- 1.5 PROJECT RECORD DOCUMENTS
  - A. Submit under provisions of Sections in divisions 0 and 1.
  - B. Refer to Section 16010.
  - C. Accurately record actual locations of each lighting fixture and branch circuitry.
- 1.6 OPERATION AND MAINTENANCE DATA
  - A. Submit under provisions of Sections in divisions 0 and 1.
  - B. Refer to Section 16010.
  - C. Maintenance Data: Submittal data sheets.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standard listed in Section 16010.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. Products shall bear the U.L. Label.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

- A. Provide fixtures as specified on the Drawings.
- B. Install ballasts, lamps, and specified accessories at factory.

2.2 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

- A. Provide emergency lighting units and exit signs as specified on the drawings.

2.3 BALLASTS

- A. Fluorescent Ballast:
  - 1. Manufacturers:
    - a. Advance - Mark V Series
    - b. Magnetek - Triad Series
    - c. Universal - Genesis Series
    - d. Valmont - Ultra-miser Series
    - e. Approved equal under provisions of Sections in divisions 0 and 1.

2. Description:

- a. Class P, high power factor type electronic ballast.
- b. Provide ballast suitable for lamps specified.
- c. Voltage: As indicated.
- d. THD less than 20 percent.
- e. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.

B. Compact Fluorescent Ballast:

1. Manufacturers:

- a. Advance
- b. Universal
- c. Valmont
- d. Approved equal under provisions of Sections in divisions 0 and 1.

2. Description:

- a. High power factor electronic type.

C. Fluorescent Dimming Ballasts:

1. Manufactures

- a. Advance AMarks X≅
- b. Lutron AEC01C≅
- c. Prescolite AIntelect≅

d. Approval equal under provisions of sections in Divisions 0 and 1.

2. Description:

- a. Solid state electronic type.
- b. Designed to control T8 lamps.



- c. Dimming range of 100 to 10 percent.
- d. Dimming by phase control method.
- e. THD less than 20 percent.
- f. Power factor 95 percent minimum.
- g. Compatible with dimmer control.

D. High Intensity Discharge (HID) Ballast:

1. Manufacturers:

- a. Advance
- b. Universal
- c. Valmont
- d. Approved equal under provisions of Sections in divisions 0 and 1.

2. Description

- a. High-Intensity-Discharge (HID) Ballasts shall be constant wattage autotransformer (CWA) or regulator, high power factor type. Ballasts shall be designed to operate on the voltage system and lamp to which they are connected. Provide single lamp ballasts with a minimum starting temperature of minus 30 degrees Celsius (C). Ballasts shall be constructed so that open circuit operation will not reduce their average life. High Pressure Sodium (HPS) ballasts shall have a solid state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature.
- b. Provide ballast suitable for lamp specified.
- c. Voltage: As indicated.

2.4 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

A. For Linear T8 Lamps:

1. Manufactures:

- a. Bodine - B50 Series

- b. Chloride - CFP8-4 Series
  - c. Emergi-Lite - EPSI/U Series
  - d. Universal - 8500 Series
  - e. Approved equal under provisions of Sections in divisions 0 and 1.
- 2. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
  - 3. Lamp Ratings: Two F32T8CW lamp providing 900 to 1100 initial lumens, minimum
  - 4. Battery: Sealed nickel cadmium type, with integral charger, rated for 10 year life.
  - 5. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled fixture.
- B. For Compact Fluorescent Lamps:
- 1. Manufactures:
    - a. Bodine
    - b. Chloride
    - c. Emergi-Lite
    - d. Approval equal under provisions of sections in Division 0 and 1.
  - 2. Description:
    - a. Suitable for installation on the fixture and serviceable thru the fixture opening.
    - b. Designed to operate one twin, quad or triple twin tube lamp at 450/950 initial burners for 90 minutes.
    - c. Integral charger, high temp nickel cadmium battery and required electronic circuitry.
    - d. Test switch, indicator light, monitor plate and mounting hardware.

## 2.5 INCANDESCENT LAMPS

### A. Incandescent Lamp:

1. Manufacturers:
  - a. General Electric
  - b. Sylvania
  - c. Philips
  - d. Approved equal under provisions of Sections in divisions 0 and 1.
2. Description: 120 volt, inside frosted or reflector type.

### B. Fluorescent Lamps:

1. Manufacturers:
  - a. General Electric
  - b. Sylvania
  - c. Philips
  - d. Approved equal under provisions of Sections in divisions 0 and 1.
2. Description: T8, rapid start type, medium bipin, 4100 degree K, minimum color rendering index of 75.

### C. Compact Fluorescent Lamps

1. Manufacturers:
  - a. General Electric
  - b. Sylvania
  - c. Philips
  - d. Approved equal under provisions of Sections in divisions 0 and 1.
2. Description: Twin or quad tube, 3500-4100 degree K.

D. High Intensity Discharge (HID) Lamp:

1. Manufacturers:

- a. General Electric
- b. Sylvania
- c. Philips
- d. Venture
- e. Approved equal under provisions of Sections in divisions 0 and 1.

2. Description:

- a. Metal Halide - Phosphered type.
- b. High Pressure Sodium - Diffuser coated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturers instructions.
- B. Install the fixtures where indicated, but make adjustments using the same numbers of fixtures in accordance with the Architectural reflected ceiling plan where ceilings exist and verified to be compatible with system.
- C. Where suspended ceilings are involved, coordinate recessed fixture types and trims with actual installed ceiling system, and provide all necessary frames and trim to properly complete each particular installation.
- D. Support luminaires larger than 2 x 4 foot (.6 mm x 1.2 mm) size independent of ceiling framing.
- E. Install wall mounted fixtures, emergency lighting units and exit signs at height indicated on Drawings.
- F. Install accessories furnished with each fixture.
- G. Connect fixtures and emergency lighting units to branch circuits using flexible conduit.

- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture.
- I. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.
- J. Install specified lamps in each fixture, emergency lighting unit and exit sign.
- K. Recessed lay-in type fluorescent fixtures shall be secured to the ceiling tee bar by running a self-tapping screw through the vertical part of the tee bar main runners only and the fixture at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.
- L. Surface and wall mounted fixtures shall be secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, slab, stud or other support added for this purpose. Do not secure or support the weight of the fixtures from gypboard on walls or any ceiling material. Fixtures attached to ceiling tees shall be attached to the main runners only with at least two positive clamping devices such as U-bolts. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above.
- M. Where fluorescent fixtures are suspended with chain hangers, the hangers shall be secured to the fixture and the structure with screws or bolts. Do not use clips or fasteners.
- N. Recessed flanged type fluorescent fixtures shall be secured using adjustable swing-gate type hangers that fit over the ceiling support member around the opening and adjusted to secure the fixture flange tight against the ceiling. The hangers shall be adjustable from inside the fixture and a minimum four shall be provided for each fixture. A self-tapping screw shall be run through the end cap of the fixture and the vertical part of the ceiling framing at each of the four corners of the fixture. In addition, support the fixture from the structure above with two 12 gauge steel wires attached to the fixture at diagonally opposite corners.

- O. Recessed incandescent, compact fluorescent and H.I.D. fixtures installed in lay-in type ceilings shall be supported from the tee bar system using suspension bar hangers designed for the purpose that fasten to the vertical part of the tee bar. Support the fixture from the main runners only. Do not secure to or support the weight of the fixture from the ceiling material. Secure the bar hanger to the tee by running a self-tapping screw through the vertical part of the ceiling tee and the fastener on each end of the bar hanger. In addition support the fixture from the structure above with one 12 gauge steel wire attached to the fixture at a point as near to the center as possible.
- P. Recessed incandescent, compact fluorescent and H.I.D. fixtures installed in non-lay-in type ceilings shall be supported from the ceiling support system using suspension bar hangers designed for the purpose that fasten to the support system. Do not secure to or support the weight of the fixture from the ceiling material. Secure the bar hanger to the support system by running a self-tapping screw through the vertical part of the ceiling support and the fastener on each end of the bar hanger. In addition support the fixture from the structure above with one 12 gauge steel wire attached to the fixture at a point as near to the center as possible.
- Q. Fixtures recessed in walls shall be secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, stud or other support added for the purpose. Do not secure or support the weight of the fixture from gypboard on walls. Provide two screws on opposite sides or top and bottom of the fixture.
- R. Exit signs shall be secured to an outlet box with a minimum of two screws. The outlet box shall be secured as specified in Section 16130.
- S. Under cabinet fluorescent fixtures shall be secured to the underside of millwork with screws installed on 12 inch (300 mm) centers for the length of the fixture.
- T. Surface and wall mounted fixtures larger than 8 inches (200 mm) in any dimension or weights more than 40 pounds (1.8 kg) shall be supported independently of the outlet box and secured with a minimum of four bolts or screws. Do not use clips or fasteners. The bolts or screws shall be run through or into a structural member, concrete or masonry wall, or ceiling support member, stud or other support

added for this purpose. Do not secure or support the weight of the fixture from gypboard on walls or any ceiling material. Smaller fixtures shall be supported from the outlet box and secured with a minimum of two screws. The outlet box shall be secured as specified in Section 16130.

Fixtures attached to ceiling tees shall be attached to the main runners only with at least two positive clamping devices. Rotational spring catches or other clips shall not be used. A 12 gauge steel wire shall be attached to each clamping device and to the structure above.

### 3.2 FIELD QUALITY CONTROL

- A. Operate each fixture after installation and connection. Inspect for proper connection and operation.

### 3.3 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Adjust exit sign directional arrows as indicated.
- C. Relamp luminaires at Substantial Completion.

### 3.4 CLEANING

- A. Remove dirt and debris from enclosure.
- B. Clean lenses and reflector surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

END OF SECTION





SECTION 16721

FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm control panels.
- B. Manual fire alarm stations.
- C. Automatic smoke and heat detectors.
- D. Fire alarm signaling appliances.
- E. Auxiliary fire alarm equipment.

1.2 RELATED SECTIONS

- A. Section 14245: Hydraulic Elevators - Passenger.
- B. Section 15855 - Air Handling Units with Coils.
- C. Section 15910 - Ductwork Accessories.
- D. Section 15980 - HVAC control system.
- E. Section 16010 - General Provisions - Electrical.
- F. Section 16111 - Conduit.
- G. Section 16123 - Building Wire and Cable.
- H. Section 16130 - Boxes
- I. Section 16170 - Grounding and Bonding
- J. Section 16180 - Equipment wiring Systems
- K. Section 16190 - Supporting Devices
- L. Section 16191 - Seismic Restraint Systems
- M. Section 16195 - Electrical Identification

1.3 CODES AND STANDARDS

- A. NFPA 70 - National Electrical Code.

- B. NFPA 72 - National Fire Alarm Code.
- C. NFPA 101 - Life Safety Code.
- D. UL 268: Smoke Detectors for Fire Protective Signaling Systems.
- E. UL 268A: Smoke Detectors for Duct Application. Rev. 3/86
- F. UL 521: Heat Detectors for Fire Protective Signaling Systems.
- G. UL 864: Control Units for fire Protective Signaling Systems.
- H. SBC - Standard Building Code.
- I. SFPC - Standard Fire Prevention Code.
- J. UBC - Uniform Building Code.
- K. BOCA - Basic National Building code.
- L. Local Codes and Ordinances
- M. ANSI S3.41 - Audible Emergency Education Signal.
- N. ADA - Americans with Disabilities Act.
- O. UFAS - Uniform Federal Accessibility Standards.

#### 1.4 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, manual and automatic local fire alarm system with connections to an automatic dialer system to dial selected phone numbers in the event of an alarm or system trouble.

#### 1.5 SUBMITTALS: Submit under provisions of Division 0 & 1 and Section 16010.

- A. Shop Drawings: Provide system wiring diagram showing each device and wiring connection required. Provide floor plans showing device locations and conduit routing and sizes.
- B. Data Sheets: Submit as a minimum the following information on each different device, control panel, and annunciator. The information shall be in the form of the manufacturer's standard product data sheets.

1. Control Panel
  - a. Manufacturer's series or catalog number
  - b. Highlight or otherwise indicate the features specified.
  - c. Dimensioned picture or drawings.
2. Initiating Devices
  - a. Manufacturer's series or catalog number.
  - b. Type of device
  - c. Ratings
  - d. Mounting type
  - e. Mounting base
  - f. Auxiliary devices
  - g. Dimensioned picture or drawing
3. Signaling Devices
  - a. Manufacturer's series or catalog number
  - b. Type of device
  - c. Ratings
  - d. Mounting type
  - e. Annunciator elevation and legend
  - f. Dimensioned picture or drawing
4. Auxiliary Devices
  - a. Manufacturer's series or catalog number
  - b. Type of device
  - c. Ratings
  - d. Mounting type
  - e. Dimensioned picture or drawing

5. Wiring

- a. List the NEC designations for the wiring to be used and what it is to be used for.

- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, start-up and testing of the system.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Record actual locations of initiating devices, signaling devices and control and annunciator panels.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in divisions 0 and 1.
- B. Refer to Section 16010.
- C. Operation Data: Operating instructions.
- D. Maintenance Data: Maintenance and repair procedures, shop drawings and submittal data sheets.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with codes and standards listed in Section 16010.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.10 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70, NFPA 72 and NFPA 101.

- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated. All products shall bear the UL Label.

#### 1.11 COORDINATION

- A. The locations of devices indicated on the drawings are approximate. Coordinate the exact location with the architectural details and equipment.
- B. Coordinate the fire alarm system with the Division 15 and all other appropriate Sections.

#### 1.12 EXTRA MATERIALS

- A. Furnish under provisions of Sections in divisions 0 and 1.
- B. Provide six keys of each type.
- C. Provide three of each type of automatic smoke detector without base.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Edward Systems Technology
- B. Notifier
- C. Simplex
- D. Pyrotronics
- E. Approved equal under provisions of Sections in divisions 0 and 1.

#### 2.2 FIRE ALARM CONTROL PANEL

- A. System Description: Addressable, non-coded, continuously ringing, fully supervised fire alarm system. The control panel, annunciator and all devices and system components shall be UL Listed as a system. All equipment and devices shall be of the same manufacturer. The sequence of operation shall be as indicated on the drawings. Signaling shall conform to ANSI S3.41.
- B. Control Panel: Modular microprocessor based construction with flush or surface mounted enclosure as indicated. The capacity shall be 127 points expandable to 512 with 25 percent spare points.
- C. Power supply: Power limited; adequate to serve control panel modules, remote detectors, remote annunciators, door

holders, relays, and/or zone modules for such items as applicable, alarm signaling devices and power all required system functions. In addition, provide 20 percent spare capacity in the power supply for future additions to the system. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours and in addition, operate under full capacity for a minimum period of 5 minutes in an alarm condition.

- D. System Supervision: The system shall be fully supervised. Component or power supply failure or removal places system in trouble mode.
- E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from initiating an alarm.
- F. Signaling Line Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable that circuit from signaling an alarm.
- G. Auto Voice/Pager Dialer: The auto dialer shall send a voice message or numeric code to up to four separate local or long distance, 16 digit, phone numbers. The dialer shall automatically skip to the next number when a line is busy. Dialing shall be continuous and will stop when the alarm input is reset. It shall be programmable for normally open, normally closed contacts or voltage inputs. It shall have a key pad and function keys to program numbers and voice message with LED display to show keyed-in phone numbers, verification of stored phone numbers and play back the voice message through an integral speaker. The dialer shall have a back-up battery unit with 24 hour operating capacity.
- H. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
- I. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE switch.
- J. Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:
  - 1. Visual and audible trouble alarm indicated at fire alarm control panel.

2. Trouble signal transmitted to automatic dialer.
  3. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visual alarm is displayed until initiating failure or circuit trouble is cleared.
- K. Alarm Sequence of Operation: Actuation of initiating device places circuit in alarm mode, which causes the following system operations:
1. Activate audible and visual fire alarm signaling devices with.
  2. Transmit signal to automatic dialer.
  3. Indicate location of alarm device on fire alarm control panel and on remote annunciator panel.
  4. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
  5. Transmit signal to building mechanical systems to initiate shutdown of fans and damper operation.
  6. Transmit signal to release door hold-open devices.
- L. Alarm Reset: System remains in alarm mode until manually reset with key-accessible reset function; system resets only if initiating circuits are out of alarm mode.
- M. Lamp Test: Manual lamp test function causes alarm indication at each zone at fire alarm control panel and at annunciator panel.
- N. Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.
- O. Resound on alarm which allows resounding of audible devices in the event of an alarm on a new zone.
- P. Resound on trouble which allows resounding of the trouble sonalert when another trouble is indicated. Also provide a programmable trouble reminder initially set for 60 minutes. Every 60 minutes, the trouble sonalert will sound to remind the operator that a trouble condition exists.
- Q. Ground fault detection in wiring.

- R. Alarm Silence Inhibit to limit User liability. Alarm devices shall be silenced only by authorized personnel entering a locked control cabinet and operating the proper silence switch.
- S. Walk test for ease of system testing and maintenance. Program shall actually identify the zone being tested over the indicating device circuits. Walk test shall also be capable of the following:
  - a. Support multiple walk test groups to provide system reliability. This allows a portion of the system to be tested while the rest is 100% active.
  - b. Automatic abort for system integrity. If no zones within an active walk test group activate for 8 hours, the system will automatically abort the walk test.
  - c. As a zone is tested, the system will indicate the number of the zone as well as whether it is in trouble or alarm.
- T. Built-in transient protection per circuit.
- U. Fully field configurable, programmable and editable.
- U. Visually indicate by English language read of the zone in alarm on an 80 character, alphanumeric, LCD display on the front of the control panel.
- V. Provide UL Listed alarm verification feature for smoke detectors only. Changing of the inhibit timing shall be field adjustable.
- W. Provide timed reactivation of mechanical and elevator functions upon reset. Equipment shall be sequentially started.
- Y. The control panel shall allow for loading or editing special instructions and operating sequences on site to accommodate building changes. All software operations shall be stored in a non-volatile programmable memory within the control panel. Loss of primary and secondary power shall not erase the instructions stored in memory. The system shall have the capability to store a minimum of 300 alarm or troubles in a historical data file to be used for maintenance purposes.



- Z. Separate manual switches for system reset, alarm acknowledge, supervisory acknowledge, trouble acknowledge, and alarm silence.
- AA. Separate LED indicators for system trouble, supervisory trouble, system alarm and power on.
- BB. 26 key program interface panel.
- CC. Provide transformers, fuses and auxiliary relays for central station activation, mechanical equipment control and other functions described and required for a complete working system.
- DD. Provide initiating zone, alarm, addressable interface, RS232, and supervised input/output modules as required for a complete working system as described and indicated.

## 2.3 INITIATING DEVICES

- A. Manual Station: Semi-Flush mounted, addressable non-coded type, signal action manual station without break-glass rod. Provide manufacturer's standard backbox.
- B. Spot Heat Detector: Combination rate-of-rise and fixed temperature, rated 135 degrees F (57 degrees C and temperature rate of rise of 15 degrees F (8.3 degrees C) per minute with addressable module.
- C. Ceiling Mounted Smoke Detector: addressable photoelectric type with adjustable sensitivity, plug-in base, as indicated and visual indication of detector actuation, suitable for mounting on 4 inch (102 mm) outlet box.
- D. Duct Mounted Smoke Detector: addressable photoelectric type auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing.
- E. Remote Visual Indicators: LED type visual indication of smoke detector status, suitable for mounting on a standard single gang outlet box. Provide manufacturer's standard prelabeled coverplate.
- F. For water flow, Tamper and other contact type devices, provide an addressable interface Module, to provide a unique address in the system. Provide the number of modules as required for each sprinkler flow and tamper

switch connection and other contact monitoring point as indicated on the drawings, and as required for a complete operating system in accordance with the sequence of operation and applicable codes.

## 2.4 SIGNALING DEVICES

- A. Visual Signal Device: ADA approved strobe lamp and flasher with red lettered "FIRE" on white background.
- B. Combination Audible (Horn) and Visual Signal Device: NFPA 72, flush projector type, as indicated fire alarm horn. Sound Rating: 92 dB at 10 feet (3M). Provide integral ADA approved strobe lamp and flasher with red lettered "FIRE" on white background.
- C. Remote Graphic Annunciator: Provide supervised remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in flush or surface wall-mounted enclosure as indicated. The annunciator shall visually indicate by English language the zone in alarm or trouble on an 80 character, alphanumeric, LCD display.
- D. Provide a signal interface module to provide addressability of alarm signal circuits. Provide the number of modules as required for a complete operating system in accordance with the sequence of operation and applicable codes.

## 2.5 AUXILIARY DEVICES

- A. Door Release: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage: 24 VDC
- B. Provide a control interface module, to provide addressable control of fire alarm functions. Provide the number of modules as required at the points of control such as motor starters or controllers, sprinkler preaction valves, shunt type circuit breakers, HVAC control electric/pneumatic (EP) switches, etc. indicated on the drawings and as required for a complete operating system in accordance with the sequence of operation and applicable codes.

## 2.6 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Circuits: National Electrical Code listed copper wiring, and cable of the size and type indicated on the manufacturer's shop drawings.

## 2.7 SOFTWARE PROGRAMMING

- A. All software shall be provided to provide a complete operating system able to perform all of the items described in the sequence of operation and all graphic displays.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's shop drawings, instructions and the listed codes and standards.
- B. All smoke detectors for the entire fire alarm system, including those located within the AC equipment and/or ducts, shall be furnished and wired under the Electrical Section. Smoke detectors located in the AC units and/or ducts shall be properly installed therein by the AC Section, ready for electrical connections; all other smoke detectors shall be installed by the Electrical Section.
- C. Mounting heights of wall mounted devices shall be as indicated.
- D. See the architectural reflected ceiling plan for the exact location of devices mounted flush in or surface mounted on the ceiling.
- E. Install all fire alarm system wiring in conduit.
- F. Provide all outlet and backboxes as required by the manufacturer in accordance with their specifications.
- G. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.
- H. Make conduit and wiring connections to sprinkler flow switches, and sprinkler valve tamper switches, and fire suppression system control panels.
- I. Devices and backboxes in or on the ceiling shall be supported by the ceiling support system using support channels or hangers. the weight of the device or the backbox shall not be supported by the ceiling material.
- J. A 90 degree angle bracket shall be installed on each end of each support channel with a self-tapping metal screw run through each bracket and the ceiling support tee to secure the bracket to the tee. If a support channel with a integral tee bar fastener is used, a self-tapping metal

screw shall be run through each fastener and the ceiling support tee to secure it to the tee. Devices and backboxes shall be supported from the main runners only.

- K. Ceiling mounted smoke detectors shall be secured to the backboxes with a minimum of two screws of size required by the detector manufacturer.
- L. Backboxes flush mounted in gypboard and stud walls for semi-flush and wall mounted audio-visual signal devices shall be secured to the studs and/or bracing with four screws; two in top and bottom, opposite sides, or each corner of the back. Provide vertical and horizontal bracing in the wall to support the weight of the audio visual device and receive the screws.
- M. Provide a bushings with an insulated throat on the ends of all conduits where they terminate in outlet or junction boxes, equipment cabinets, etc.
- N. Conduit types, fittings, routing and support shall be as specified in Section 16111, 16190 and 16191.
- O. Outlet and backboxes shall be supported as specified in Section 16130, 16190 and 16191 unless otherwise specified.
- P. The Fire Alarm Control panel and Annunciator shall be secured to walls with a minimum of four bolts. Where supported on concrete, masonry or block walls, anchors or other devices designed for this purpose shall be used. Where supported on gypboard and stud walls, vertical and horizontal bracing in the wall shall be provided to support the weight of the panel and its contents and to receive the bolts or screws.
- Q. Provide a laminated plastic sign attached to the front outside the control panel and annunciator with a minimum of two screws which reads "Fire Alarm Control Panel" and "Fire Alarm Annunciator" respectively. The sign shall be white with 1/2" (13 mm) high red characters. Provide a separate sign of the same specification that indicates the power circuit number for the fire alarm control panel.
- R. Where smoke detectors are mounted in ducts above the ceiling, mount the remote LED indicator through the ceiling, at the smoke detector location, so that it will be visible from the corridor or room. Provide a 3/4 inch (19 mm) wide by length required, laminated white plastic nameplate engraved with "Duct Smoke Detector" in 1/2 inch

(13 mm) high red letters. Permanently attach the nameplate to the ceiling support grid next to the indicator.

- S. All wire shall be tagged at all junction points and shall test free of grounds or crosses between conductors.
- T. Final connections between equipment and system wiring shall be made under the direct supervision of a representative of the manufacturer.
- U. Equipment shall be installed by a duly licensed electrical contractor or a duly licensed Fire Alarm Installer as required by local code. The equipment warranty must be provided by a licensed Fire Alarm Supplier.
- V. The covers of all pull boxes and junction boxes in the conduit system for the fire alarm system shall be painted red to identify them.
- W. Provide tamper switches on all junction boxes mounted exposed and at or below an elevation of 8 feet (2.4 m) above the finished floor or grade. A trouble alarm shall be activated if the coverplate is removed.

### 3.2 FIELD QUALITY CONTROL

- A. Following complete installation, perform all operations specified and tests in presence of the Government's, local fire Department's, and Engineer's representative. The contractor and equipment supplier shall provide all equipment and personnel to perform the tests.
- B. Test in accordance with NFPA 72 and local fire department requirements.

### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Include services of certified technician to supervise installation, adjustments, final connections, check-out, and system testing.

#### 3.4 OWNER ORIENTATION AND INSTRUCTION

- A. A representative of the fire alarm system manufacturer shall meet with representatives of the Government at the time of the final acceptance of the system and shall train the Government's representatives in the operation of the system and review the operation and maintenance manuals to be provided to the Government and recommend maintenance procedures.

END OF SECTION

SECTION 16741

TELEPHONE AND DATA WIRING SYSTEM, INSIDE PLANT

PART 1 GENERAL.

1.1 REFERENCES:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Technical documents that form a part of the documents below are also applicable as project guidelines.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE C2 (1996) National Electrical Safety Code

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C388 (1973) Softening Point of Glass

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

TELECOMMUNICATIONS INDUSTRIES ASSOCIATION (TIA)

TIA/EIA-568-A (1995) Commercial Building  
Telecommunications Cabling Standard  
(ANSI/TIA/EIA-568-A-95)

TIA/EIA-568-A/TSB-67 (Nov 95) Technical Systems Bulletin,  
Link Performance Transmission  
Specification for Field Testing of  
Unshielded Twisted Pair Cable Systems

EIA/TIA-569 (1990) Commercial Building Standard for  
Telecommunications Pathways and Spaces  
(ANSI/EIA/TIA-569-90)

TIA/EIA-606 (1993) Administration Standard for the  
Telecommunications Infrastructure of  
Commercial Buildings (ANSI/TIA/EIA-606-  
93)

TIA/EIA-607 (1994) Commercial Building Grounding  
and Bonding Requirements for  
Telecommunications (ANSI/TIA/EIA-607-  
94)

EIA/TIA-455-A (1991) Standard Test Procedures for  
Fiber-Optic Fibers (ANSI/EIA/TIA-455-A-  
91)

EIA/TIA 455-47B (1992) FOTP-47 Output Far Field  
Radiation Pattern Measurement  
(ANSI/EIA/TIA-455-47B-92)

BELLCORE

BELLCORE TR-TSY-000268 (Issue 3; May 89; Supple; 1 June 90)  
ISDN Access Call Control Switching and  
Signaling Requirements

DEFENSE INFORMATION SYSTEMS AGENCY (DISA)



DISA DCAC 370-175-13 (5 April 88) DSN System Interface  
Criteria

CODE OF FEDERAL REGULATIONS (CFR)

CFR 47 Part 68 Connection of Terminal Equipment to  
Telephone Network

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL Publication (1995) UL's LAN Cable Certification  
Program

UL Publication (Jan 1996) Verified LAN Cable Products  
Directory

Pub. Ref. No. 1 (Apr 91) Electrical Construction  
Materials List

UL 94 (1991; Rev Aug 1992) Tests for  
Flammability of Plastic Materials for  
Parts in Devices and Appliances

## 1.2 GENERAL DESCRIPTION:

A premises distribution system consisting of entrance facilities telecommunications closets, backbone and horizontal pathways, inside plant cables, voice instruments, and other auxiliary equipment comprising a complete system for voice and data communications shall be provided as indicated on drawings.

### 1.2.1 OPERATING CONDITIONS:

The electronic equipment designed for office environments shall be rated for continuous operation under ambient environment conditions of 50 degrees F to 85 degrees F and 35 to 65 percent relative humidity, noncondensing.

## 1.3 GENERAL REQUIREMENTS.

1.3.1 All equipment and all work under this section shall be furnished and installed by a certified telecommunications contractor, hereafter referred to as the Contractor. Paragraph 1.4, Contractor Qualifications, further defines this requirement.

### 1.3.2 Minimal Requirements:

All specifications are minimal requirements.

### 1.3.3 UL Listing:

1.3.3.1 Materials and equipment requiring UL 94 listing shall so be labeled.

1.3.3.2 Modification of products which nullifies UL label is not permitted.

## 1.4 CONTRACTOR QUALIFICATIONS.

### 1.4.1 Verification:

The Contractor shall submit verification of the qualifications specified below with the shop drawings submittals. The Contractor shall have the following minimum qualifications in Telecommunications Systems.

1.4.1.1 The Contractor shall have a minimum of five years experience in the design, application, installation and testing of the specified systems and equipment.

1.4.1.2 The Contractor shall employ industry trained personnel to perform systems engineering and design. All system designers and engineers shall have a minimum of three years experience on the specified system and all recommended components.

1.4.1.3 All supervisors and installers assigned to the installation of this system or any of its components shall have industry training for each area of installation. The supervisors and installers shall also have factory certification on all components used in the installation. General electrical trade staff (electricians) shall not be used for the installation of the fiber optic and unshielded twisted pair (UTP) cables and associated hardware.

1.4.1.4 All installers assigned to the installation of this system or any of its components shall have a minimum of one year experience in the installation of the specified fiber optic and Category 5 UTP cable and associated hardware. Installation supervisors shall have a minimum of three years experience in the installation of the specified fiber optic and Category 5 UTP cable and associated hardware.

#### 1.4.2 Minimum Manufacturer Qualifications:

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of three years experience in producing the types of systems and equipment specified.

#### 1.5 SUBMITTALS:

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

##### SD-01 Data

##### Manufacturer's Catalog Data; GA

Data composed of manufacturer's catalog cuts, brochures, circulars, specifications and product data, and other information in sufficient detail and scope to verify compliance with requirements of the contract documents. This shall include a description of the system operating characteristics and individual data sheets for each item of equipment indicating descriptive and technical data, operating temperature limits, and mounting restrictions. If a data sheet covers several types or sizes of equipment, the sheet shall be marked to indicate the specific item provided.

##### Spare Parts Data; GA

These are data lists of tools and test equipment for each different item of material and equipment specified, after approval of detail drawings not later than one month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

##### SD-04 Drawings

##### Detail Drawings; GA

Detail drawings include complete riser diagrams, wiring and schematic diagrams, run sheets including number of conductors and wire number (ID), custom assembly details, installation details, and any other details required to demonstrate that the system complies with specifications, has been coordinated and shall properly function as a unit. Installation drawings shall be to scale with critical dimensions shown.

Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearance for maintenance and operations, and plan and elevation details.

#### Coordination Drawings; GA

Coordination drawings shall show all electronic and physical interface details.

#### As-Built Drawings; FIO

As-built drawings shall conform to Section 01040 AS-BUILT DRAWINGS. As-built drawings shall show final systems configuration, including location, type, gauge, and block and terminal assignment of inside wiring, and floor plan layout for the equipment, after installation.

#### SD-06 Instructions

##### Manufacturers' Recommendations; GA

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be received and approved by the Government, prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

#### SD-08 Statements

##### Test Plan; GA

This deliverable is a test plan defining all tests required to ensure that the system meets technical, and operational and performance specifications, delivered 60 days prior to proposed test date. The test plans and test procedures shall explain in detail, step-by-step, actions and the expected results to demonstrate compliance with the requirements of this specification.

Test plans shall include a list of all test equipment to be used, test data sheets, and names and qualifications of the person(s) that will be performing the tests.

## SD-09 Reports

### Test Reports; FIO

These are test reports, in booklet form, showing all field tests performed to adjust each component, and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system.

### Qualifications; GA

The qualifications of the Manufacturer(s), Contractor(s), and the Installer(s) to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

## SD-14 Certificates

### Premises Distribution System; GA

Written certification that the premise distribution system fully complies with the TIA/EIA-568-A, EIA/TIA 569, TIA/EIA 606, and TSB 67 standards.

### Station Cables; GA

### Plates and Jacks; GA

### Instrument (BRI); GA

This is a manufacturer's certificate indicating compliance with transmission and reliability requirements. Where equipment or materials are specified to conform to the standards or publications and requirements of CFR, EIA, and ICEA, certificates attesting that the items furnished under this section of the specification conform to the specified requirements will be furnished.

### Installers; GA

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

## SD-19 Operations and Maintenance Manuals

### Manufacturer's Manuals; GA

Commercial off the shelf manuals for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment.

## 1.6 SYSTEM DESCRIPTION:

The telephone system, inside plant (ISP), shall provide the specified cabling, connection points, and jacks to support (GFGI or Contractor installed) voice, data, and station terminal apparatus. The ISP shall be constructed with Category 5 UTP and multimode fiber horizontal cabling to termination jacks, as indicated on drawings

## 1.7 DELIVERY AND STORAGE:

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

## Part 2 PRODUCTS

### 2.1 STANDARD PRODUCTS:

All materials and equipment as provided shall be standard Commercial-Off-The-Shelf (COTS) products of a manufacturer(s) regularly engaged in the manufacture of the products. All products shall be the manufacturer's latest standard design that is typical commercial design, and that complies with the requirements specified. All material and equipment shall be readily available through the manufacturers and/or distributors.

#### 2.1.1 Modifications:

Modification of products which nullifies UL label or other agency approval is not permitted. Modification of product(s) at the module level, component level, or in the software which would result in a non-standard product offering as described in paragraph 2.1 above is not permitted.

#### 2.1.2 Condition:

All products shall be new and free of defects or material abnormalities.

#### 2.1.3 Identical Items:

Items of the same functional classification shall be identical. This requirement includes equipment, modules, assemblies, connectors, parts, firmware, and components for the entire system.

## 2.2 NAMEPLATES:

Each major component of equipment shall have the manufacturer's name, model number, and serial number on a plate secured to the equipment.

## 2.3 INSIDE CABLING.

### 2.3.1 Backbone (Riser) Cables.

#### 2.3.1.1 Copper Cables.

Copper cables which interconnect interior telecommunications closets shall conform to TIA/EIA-568-A Category 3 100-ohm UTP for backbone cables. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating performance level. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70. All cables shall have solid-copper conductors. The cable shall be provided with the number of conductor pairs of the American Wire Gauge (AWG) specified on the drawings (i.e., 400-24 is 400 pairs of 24 AWG copper conductors). Each end of the copper riser cable shall terminate on a wall mounted 110 Type connecting blocks.

#### 2.3.1.2 Fiber Optic Cables.

The fiber optic cables which interconnect interior telecommunications closets shall conform to TIA/EIA-568-A for single-mode optical fiber backbone cable. One hundred percent of the fibers shall be certified. The cable shall be provided with the number of fibers specified on the drawings (i.e., 24 ST SM is 24 strands single mode). Each end of the fiber riser cable shall terminate on rack mounted fiber optic patch panels. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

##### 2.3.1.2.1 Numerical Aperture.

The nominal numerical aperture of each optical fiber shall be 0.13 plus or minus 0.02. The method of numerical aperture measurement shall be in accordance with EIA/TIA 455A.

##### 2.3.1.2.2 Softening Point.

The softening point of the clad material of the optical fiber shall be 1630 degrees C plus or minus 50 degrees C in compliance with ASTM C338-73.

##### 2.3.1.2.3 Connectors.

Connectors shall be duplex 568SC type with ceramic ferrule material with a maximum insertion loss of .5 Db. Connectors shall meet performance requirements of TIA/EIA-568-A. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service.

### 2.3.2 Horizontal Cables.

#### 2.3.2.1 Copper Cable:

All unshielded twisted-pair (UTP) horizontal cable between the telecommunication outlet and modular RJ-45 patch panel shall conform to TIA/EIA-568-A, configured for the eight position jack pin/pair assignments, designation T568A. Unless otherwise specified, all UTP cabling shall be Category 5, solid copper conductor, 4-pair, 24 AWG, and shall comply with TIA/EIA-568-A for Category 5 cable. Only UTP cable that has passed and been accepted by the UL LAN Cable Certification Program shall be used. The cable surface shall be marked with the acceptable UL cable markings Verified (UL) Category 5, Classified (UL) Category 5, where CAT may be substituted for Category. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

#### 2.3.2.2 Fiber Optic Cable:

The fiber optic horizontal cable between the telecommunication outlet and the fiber optic patch panel shall be four strand multimode graded index optical fiber cable. The fiber optic horizontal cable shall conform to TIA/EIA-568-A for fiber optic cable. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

##### 2.3.2.2.1 Connectors.

Connectors shall be duplex 568SC type with ceramic ferrule material with a maximum insertion loss of .5 dB. Connectors shall meet performance requirements of TIA/EIA-568-A. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service.

### 2.3.3 Plates and Jacks.

#### 2.3.3.1 Telecommunications Outlets:

All in-wall outlet boxes shall be standard UL approved, steel AC power type double gang boxes, capable of directly mounting a blank outlet cover. In-wall boxes shall be attached to the



structure without the use of the cover or its attachment points.

Wall plates shall come equipped with two modular four pair RJ-45 jacks, with one jack labeled "voice" and the other jack labeled "data" and four multimode fiber optic 568SC type connectors labeled A and B, etc. in accordance with TIA/EIA 606 and as indicated on the Standard Diagram. The modular jacks shall be configured for the eight position jack pin/pair assignments, designation T568A and shall conform to TIA/EIA-568-A for Category 5, NFPA 70 and CFR 47 Part 68. Mounting plates provided for systems furniture shall match the systems furniture in color.

#### 2.3.3.2 Wall and Pay Telephone Outlets:

All wall and pay telephone outlet boxes shall be standard UL approved steel AC power type single gang boxes, capable of directly mounting a lug-type outlet cover. Wall boxes shall be attached to the structure without the use of the cover or its attachment points. Wall plates shall come equipped with a single modular RJ-45 type jack. Jacks shall conform to CFR 47 Part 68 and NFPA-70 and TIA/EIA-568-A for Category 5 connecting termination hardware and the eight position jack pin/pair assignments, designation T568A.

#### 2.3.4 Station Line Cord:

Station line cords shall be modular between the outlet and the base of the telephone instrument, at least six feet in length, 26 AWG, two or four pair (dependent on instrument type).

#### 2.3.5 Telephone Backboard:

Telephone backboard shall be constructed of  $\frac{3}{4}$  inch ACX plywood and be coated on both sides with two coats of fire retarding, insulating varnish, as a minimum.

#### 2.3.6 Cable Management:

Telephone backboards shall be provided with standard cable management rings and wire-ways to support the cabling, as shown on project drawings. Cable management shall be used for both the vertical and horizontal cabling on the backboard. The quantity of cable management rings and wire-ways shall be based upon the cable size and number of 110 type blocks. Cable management rings and wire-ways fill shall not exceed 60 percent.

#### 2.3.7 Terminal Blocks:

Terminal blocks shall be 110D-type, wall mounted wire termination units consisting of insulation displacement, gas tight connector blocks, wired for TIA/EIA-568-A, configuration T568A. Blocks

shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall be plated, shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals. Connecting termination hardware shall conform to TIA/EIA-568-A for Category 5.

#### 2.3.8 Patch Panels.

##### 2.3.8.1 Voice Patch Panels:

UTP patch panels for voice cable shall be 48 port minimum, 4 pair RJ-45 to Amphenol (50-pin) connector patch panels, 19" rack mountable. Connecting termination hardware shall conform to TIA/EIA-568-A for Category 5. The RJ-45 connectors shall be configured as the eight position jack pin/pair assignments, designation T568A. The number of RJ-45 connectors shall be based on the riser cable counts shown on project drawings (one RJ-45 appearance per four-pair riser cable).

##### 2.3.8.1.1 Horizontal Patch Panels.

##### 2.3.8.1.2 UTP Patch Panel:

UTP patch panels shall be 48 port minimum, 4 pair RJ-45 to 110-Type Modular Patch panels, 19 inch rack mountable. Connecting termination hardware shall conform to TIA/EIA-568-A for Category 5. The RJ-45 connectors shall be configured as the eight position jack pin/pair assignments, designation T568A. The number of RJ-45 connectors shall be based on the number of user outlets or Category 5 cable counts shown on project drawings.

##### 2.3.8.1.3 Multimode Fiber Patch Panel:

The patch-panels for the multimode fiber shall be rack mountable fiber enclosures with 62.5/125 micron multimode, SC-type feed-through couplers. The fiber enclosures shall come equipped with routing rings and tie down clamps for the fiber optic cable. Incoming fiber-optic cables shall be terminated at the rear of the patch panel. The number of SC couplers shall be based on the number of fiber optic cable counts shown on project drawings.

##### 2.3.8.1.4 Singlemode Patch Panel:

The patch-panel for the singlemode fiber entering the building shall be rack mountable fiber enclosures with 8.3/125 micron singlemode, SC-type feed-through couplers. The fiber enclosures shall come equipped with routing rings and tie down clamps for the fiber optic cable. Incoming fiber-optic cables shall be

terminated at the rear of the patch panel. Fiber-optic patch cables for cross-connections shall be terminated on the front of the fiber patch panel. The number of SC couplers shall be based on the number of fiber optic cable counts shown on project drawings.

#### 2.3.8.2 UTP Patch Cables:

Patch cables both within the telecommunications closet and at the telecommunications outlet shall be unshielded twisted-pair (UTP) cable and shall conform to TIA/EIA-568-A, configured as the eight position jack pin/pair assignments, designation T568A. Unless otherwise specified, all UTP patch cabling shall be Category 5, 4-pair, 100 ohms  $\pm$  15 ohms UTP, and shall comply with TIA/EIA-568-A section for Category 5 patch cables. Only UTP cable that has passed and been accepted by the UL LAN Cable Certification Program shall be used. The cable surface shall be marked with the acceptable UL cable markings Verified (UL) Category 5, Classified (UL) Category 5, where CAT may be substituted for Category.

#### 2.3.8.3 Fiber Optic Patch Cables:

Fiber optic patch cables shall conform to the same standards as the patch panel and fiber with which they will be used. The paragraphs above on fiber cable and connector type apply.

#### 2.3.9 Telecommunications System Labeling:

The telecommunications systems labeling shall be done in accordance with ANSI/TIA/EIA 606. The Contractor shall label all outlets as to their function and with a unique identifier code. All devices, outlet locations, and designations shall also appear on the system drawings.

##### 2.3.9.1 Telecommunications Patch Panel Labeling:

Patch panel labeling shall be done in accordance with TIA/EIA 606. Each outlet location shall be labeled with a unique designator. The top or left RJ-45 type, Category 5 compliant port for each outlet location shall be designated for voice and be labeled "VOICE". The bottom or right RJ-45 type, Category 5 compliant port for each outlet location shall be designated for data and be labeled "DATA". Fiber-optic port labeling shall be done in accordance with EIA/TIA 606. The left or top SC port shall be labeled "A" and the right or bottom SC port shall be labeled "B".

#### 2.3.9.2 Telecommunications Jack Labeling:

Jack labeling shall be done in accordance with ANSI/TIA/EIA 606 and the Standard Diagram. . Each outlet location shall be labeled with a unique designator. The top or left RJ-45 type, Category 5 compliant jack shall be designated for voice and be labeled "VOICE". The bottom or right RJ-45 type, Category 5 compliant jack shall be designated for data and be labeled "DATA". All LAN components in the system shall also be labeled with similar designations in accordance with EIA/TIA 606.

#### 2.3.9.3 Fiber-Optic Jack Labeling:

Fiber-optic jack labeling shall be done in accordance with TIA/EIA 606. . The left or top SC jack shall be labeled "A" and the right or bottom SC jack shall be labeled "B".

#### 2.4 VOICE INSTRUMENT REQUIREMENTS:

Voice instruments shall be single line, fully modular, and equipped with a DTMF dialing pad and a pre-timed feature access button which simulates hook flash.

#### 2.5 EQUIPMENT RACKS:

Floor mounted equipment racks shall be welded steel relay racks with uprights to mount equipment 19 inches wide. Uprights shall be three inch deep channel, 1-1/4 inches wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top cross member, and pre-drilled base plate to allow floor fastening. Open frame equipment racks shall be seven feet in height and painted with gray finish. Each rack shall be provided with a quad 110 volt AC outlet, mounted in the bottom of the rack, as shown on project drawings.

##### 2.5.1 Cable Management:

Equipment racks shall be provided with standard cable management rings and panels to support the cabling, as shown on project drawings. Cable management shall be used for both the vertical and horizontal cabling within the rack. The quantity of cable management panels shall be based upon the number and sizes of the UTP and fiber optic patch panels. Cable management rings and panels fill shall not exceed 40 percent.

#### 2.6 TELECOMMUNICATIONS PREMISE CABLE PATHWAYS.

All telecommunications premise cable pathways and infrastructure must conform to EIA/TIA-569.

2.6.1 Rigid conduit shall be zinc plated four inch diameter Electrical Metallic Tubing (EMT) and shall comply with the following guidelines:

2.6.1.1 No single section of conduit shall be longer than 100 feet or contain more than two 90 degree bends between junction boxes or pull points.

2.6.1.2 All couplers between conduit lengths and connectors to junction boxes and pull points shall be compression type fittings.

2.6.1.3 The inside radius of a bend in conduit shall be at least six times the internal diameter. When the conduit size is greater than two inch, the inside radius shall be at least 10 times the internal diameter of the conduit. For fiber optic cable, the inside radius of a bend shall be at least 10 times the internal diameter of the conduit.

2.6.1.4 Pullcord shall be placed in installed conduit.

2.6.1.5 Conduit runs extending from a telecommunications closet, cable tray or cable raceway shall be a minimum of one inch rigid EMT.

2.6.1.6 Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.

## 2.6.2 Flexible Conduit:

Conduit used to connect to outlets in modular furniture shall be flexible ferrous metallic of a minimum of one inch inside diameter with a non-ferrous, non-conductive outer coating. Where required, flex conduit insulation shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

Fish tape or pullcord shall be placed in installed flexible conduit.

## 2.6.3 Cable Tray.

2.6.3.1 Cable tray shall be prefabricated, metallic, solid bottom channel sections, not exceeding 12 inches wide unless otherwise indicated, and installed in accordance with applicable electrical code. Sweeps with a ten inch radius shall be utilized at all horizontal cable tray intersections. Ninety degree outside or inside bend cable tray sweeps, with a minimum of a 6 inch radius, shall be used for all vertical cable tray transitions.

2.6.3.2 The inside of the installed cable tray shall be free of burrs, sharp edges, or projections that can damage cable insulation.

2.6.3.3 The cable tray shall be able to support the telecommunications cabling without exceeding 40 percent fill.

#### 2.6.4 Cable Ladder:

Cable ladder shall be prefabricated, metallic ladder, not exceeding 12 inches wide, with a maximum ladder rung spacing of six inches, and installed in accordance with applicable electrical code. Sweeps with a 10 inch radius shall be utilized at all horizontal cable ladder intersections. Ninety degree outside or inside bend cable ladder sweeps, with a minimum of a 6 inch radius, shall be used for all vertical cable ladder transitions.

#### 2.6.5 Cable Duct.

2.6.5.1 Duct shall be metallic, and have non-hinged completely removable covers that are screwed, clipped, or clamped to the duct body. All duct joints or splices shall have internal body and joint covers to prevent direct paths through the duct wall or cover. Joint covers shall be removable. Duct body joints or splices shall use a minimum of one fastener in each of the three walls. No hardware shall be required to be mounted with sharp edges protruding into the inside of the duct. Flanges made for the purpose will be used for all bulkhead connections. Ducts shall be rigid enough to support a 200 pound load in the middle of a span supported at minimum five foot intervals without permanent deformation. Sweeps with a ten inch radius shall be utilized at all horizontal cable duct intersections. Sweeps with a 6 inch minimum radius shall be used at all vertical cable duct transitions.

2.6.5.2 The cable duct shall be able to support the telecommunications cabling without exceeding 40 percent fill.

#### 2.6.5.3 Cable Pathway Labeling:

Telecommunications premise cable pathway labeling shall be done in accordance with TIA/EIA 606.

### PART 3 EXECUTION.

#### 3.1 INSTALLATION:

System components shall be installed as specified or as shown. Necessary interconnections required for a complete and operable

telephone circuit shall be provided. Installation work shall be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

### 3.1.1 Industry Standards:

All work shall be installed as indicated and specified, and in accordance with acknowledged industry, technical, and professional standards and practices, and manufacturers recommendations. Specifically, installation shall conform to the guidelines as specified in TIA/EIA-568-A, EIA/TIA-569, and NFPA 70.

### 3.1.2 Tools and Test Equipment:

The Contractor shall provide all tools and test equipment needed to install and test the system.

### 3.1.3 Miscellaneous Hardware:

The Contractor shall provide all miscellaneous hardware and accessories as required for a proper installation.

## 3.2 INTERIOR WIRING.

### 3.2.1 Cable Laying.

3.2.1.1 Interior wiring shall be installed in raceways, cable trays, and boxes as specified in their respective sections of these project specifications, and terminated at station locations indicated.

3.2.1.2 All cables between the same points shall be run over the same path.

3.2.1.3 All cables and wiring shall be installed and terminated at all station locations as indicated on project drawings. Wiring shall take the form of a "Universal Wiring Plan" where horizontal cables are wired directly, home run fashion, from a distribution point to the appropriate modular jack plate, jack assembly, or floor jack to support the use of single line type sets and electronic sets. Each individual cable run shall be continuous and uninterrupted and shall have no bridge taps, branches, splices or 'Y' connections at any point.

3.2.1.4 Cables shall be installed in accordance with applicable fire codes, the manufacturer's recommendations and the requirements listed below.

3.2.1.5 There shall be no kinks, sharp bends or deformation in the installed cable. Any bends in the cable shall meet the recommendations of the cable manufacturer.

3.2.1.6 There shall be attachments, fastenings, and supports in conformance with the cable manufacturer's recommendations for the type and size cable as installed and consistent with the installed environment.

3.2.1.7 All vertical cable runs in duct or on ladder shall be tied with plastic straps or lacing twine at the top of the run and at least every three vertical feet to prevent cable strain. Horizontal wiring shall not be bundled in groups larger than 16 cables.

3.2.1.8 A proper cable lubricant, approved by the Contracting Officer, shall be applied at the manufacturer's recommended rate during the installation of the cable assemblies into conduits. No cable lubricant is to be utilized on cable assemblies installed in cable trays.

3.2.1.9 The cable shall be installed in a manner so as to prevent crushing, stretching, abrasion, puncture, and other mechanical damage.

3.2.1.10 All cables and cross connects shall be neatly strapped, dressed and adequately supported. Provide cable clamps, strain relief devices, and ties as required to maintain the workmanlike appearance of the installation and as recommended by the manufacturer. Where required, strain relief devices and ties shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70.

3.2.1.11 In no case shall any cable be attached to any conduit, pipe, associated supporting clamp or bracket, or false (suspended) ceiling system.

3.2.1.12 No less than one foot of slack material shall be left in each horizontal cable at each outlet and no less than three feet at the telecommunications closet to facilitate maintenance.

3.2.1.13 Cables shall be installed in the conduits, cable trays, cable ladders and wireways provided and as indicated on the drawings. Cable shall not be installed outside of these wireways, including but not limited to freely suspended without support, on decks or walking surfaces, on suspended ceiling grid work, or on the work of other trades which are not specifically designated as wireways.



3.2.1.14 Horizontal cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables.

3.2.1.15 Within the telecommunications closets the cable shall be supported at all times by cable trays and cable ladders and down to the telecommunications/equipment racks or backboard as indicated on the drawings. Within the telecommunications rack or on the backboard, cable shall be supported by cable management rings and panels as indicated on the drawings. Cable shall not be placed within the 'U' frame of the rack, unless the rack is specifically designed to manage cable in such a way.

3.2.1.16 Cables shall be installed loosely within horizontal cable trays and conduits. Cables shall not be taped laced or strapped to each other or bundled in groups larger than 16 cables.

3.2.1.17 Cable shall enter and leave the cable trays in a manner which conforms to the manufacturer's recommendations and the drawings.

3.2.1.18 Backbone and horizontal cable shall be properly terminated and tagged at both ends to provide permanent station identification.

### 3.2.2 Labeling:

All cables shall be labeled in accordance with ANSI/TIA/EIA 606 within six inches of the connection with wrap-around adhesive write-on strips that seal the writing behind clear tape. The Contractor shall label all cables at each end with a unique identifier. All cables shall be labeled at each connection with their functions, local connection point, and remote connection point. Labels shall be permanent and readable from one foot. Labels shall not be removable by normal cable movement nor shall they be easily removed by hand.

### 3.2.3 Cable Pathways:

The Contractor shall furnish and install new cable tray or duct in the false ceiling, and cable ladder in the telecommunications closets as shown on the project drawings and as required and described in this section. The cable pathways shall be used to install the premises distribution system cabling based on the construction of the area. Conduits, outlets and raceways shall be installed in accordance with their respective sections of these project specifications.

### 3.2.3.1 Location:

Cable trays and duct shall be located over corridors, hallways, and other public areas, whenever possible, to avoid subscriber disruption during maintenance when the building is occupied. Private or secure areas shall be avoided. Cable pathways shall not be located near pipes, radiators, windows, doors, or any other equipment which may cause damage to the cable by exposure or detrimental conditions. Cable trays shall be located so as not to interfere with future expansion. The Contractor shall install the cable tray horizontally or vertically around, over or under the HVAC ducts to maintain the cable tray capacity as shown on the drawings.

### 3.2.3.2 Support:

The cable tray, shall be supported using the manufactures recommended support brackets, threaded rods and associated hardware. The cross strap shall not be used to support the overhead cable tray. Vertical structures such as cabinets, relay racks, frames and bays, attached to the floor for panel-mounted equipment, may be used for supporting associated cable ladder runs. The installation of all cable trays, ducts, and ladders shall conform to industry standards.

### 3.2.3.3 Grounding:

The cable pathway system shall be grounded to the AC power or building structure (one or the other per building, a combination within a building is not allowed) ground at intervals not to exceed 75 feet. This grounding may be accomplished through the mounting hardware or by separate wire (minimum 12 AWG).

### 3.2.3.4 Wall Transitions:

The Contractor shall seal holes in walls around signal ducts and conduits equivalent to that of the wall. Duct covers shall be spliced on each side of the wall (with joint shields) to allow a non-removable section of cover within the wall. Any reductions required at fire walls shall provide multiple runs through the wall totaling at least as many square inches of area as the duct or conduit running to the wall.

### 3.2.3.5 Fire Stopping:

It shall be the responsibility of the Contractor to perform any and all sealing, filling, or fire stopping through bulkhead fittings with materials and practices in compliance with applicable codes, regulations and directives.

### 3.3 OUTLETS.

#### 3.3.1 Outlet Placement:

Outlets shall be installed in the approximate positions indicated on the drawings. All telecommunications outlets shall be mounted 18 inches,  $\pm$  two inches above the finished floor (AFF) or six inches  $\pm$  two for counter tops. All wall telephone outlets shall be mounted 54 inches,  $\pm$  two inches above the finished floor for standard telephones, and 34 inches AFF for handicap access telephones.

#### 3.3.2 Wall Outlets:

Outlets shall be flush mounted on the wall. The outlets shall be steel duplex AC power type boxes fastened in the wall, without assistance from the cover. Steel conduit (a minimum of one inch) shall extend from the distribution system directly to the outlet.

### 3.4 RACKS.

#### 3.4.1 Rack Placement:

Racks shall be bolted to the true floor at all corners with minimum 3/8 inch hardware and to any adjacent racks. Racks must be positioned to allow three feet of clearance in front and behind the racks. Racks must be placed to allow complete opening of other fixed area enclosure doors or covers.

#### 3.4.2 Rack Configuration:

The Contractor shall wire AC power from a separate 20 amp circuit breaker to each rack, running the circuit in conduit (under the false floor where such exists). The Contractor shall install both vertical and horizontal cable management rings and panels in the racks as indicated on the drawings.

#### 3.4.3 Copper Patch Panels:

Category 5 copper patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus ten percent (10%) spares. Cable guides shall be provided above, below and between each panel.

#### 3.4.4 Fiber Optic Patch Panels:

Fiber optic patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus ten percent (10%) spares. A slack loop of three feet of fiber shall be provided within each panel. The outer jacket of each

cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

### 3.5 BACKBOARDS.

#### 3.5.1 Backboard Placement:

The Contractor shall provide and install telephone backboards as shown on drawings. The backboards shall be mounted to the wall at all corners with minimum 3/8 inch hardware, and shall be constructed of 3/4 inch ACX plywood with a minimum of two coatings on both sides of insulating varnish.

#### 3.5.2 Backboard Configuration:

The Contractor shall wire AC power from a separate 20 amp circuit breaker to each backboard, running the circuit in conduit. The Contractor shall install both vertical and horizontal cable management rings and panels on the backboard as required.

#### 3.5.3 Terminal Blocks:

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

### 3.6 CONNECTORS.

3.6.1 All connectors in this system shall be assembled with full compliance to the assembly standards of the manufacturer of the connector.

3.6.2 All connectors shall be assembled with tooling, dies, adhesives, and procedures recommended and approved by the connector manufacturer.

### 3.7 GROUNDING.

#### 3.7.1 General:

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices and terminals shall be grounded. The Contractor shall provide and install a Signal distribution system ground in the telecommunications entrance facility (Master Ground Bus - MGB) and in each telecommunications closet in accordance with TIA/EIA 607. Grounds may be run from building signal ground points with minimum 6 AWG wire through the appropriate signal distribution system. All outside plant cable shields shall be

bonded to this ground using minimum 12 AWG wire. The resistance from cable to ground bus can be no greater than .01 Ohms. Ground wires shall be connected with screw-down connectors to the bus. An earth ground shall be established of ten ohms or less total resistance from the MGB to, and including the ground. Equipment racks shall be connected to the electrical safety ground. Leave sufficient coil of wire to reach any part of the backboard or equipment rack.

### 3.7.2 Execution:

The Contractor shall ground all cable shields to signal ground at one end only using the facility single point ground system. Looping of shield grounds through connectors is acceptable as long as it does not result in more than one ground attachment for cables using the single point ground policy. There shall be no interconnections between AC power hazard ground and signal ground except where the two grounds cannot be separated within equipment. Cable shields may be connected to the equipment hazard ground only where there is no way to pass the signal ground through the connectors or equipment to the cable.

### 3.8 INSTALLATION INSPECTIONS:

Quality Assurance shall be provided through the performance of pre-installation, in-progress, and final inspections.

#### 3.8.1 Pre-installation Inspection:

The Contractor shall make an inspection of all equipment and materials to be utilized in this project. All items shall be verified for compliance with the requirements of this document, the installation, and other referenced standards. This inspection shall also include determination of site preparation, availability of installation materials, status of Government-furnished equipment (GFE), Contractor-furnished equipment (CFE), local purchase request (LPR) items, as well as leased equipment and transmission facilities (as applicable). The Contracting Officer or representative will participate in and witness the pre-installation inspection.

#### 3.8.2 In-Progress Inspections:

The Contractor shall perform in progress inspections which shall include visual inspections of equipment condition, wiring, splicing, fiber-optic cabling, mounting and placement of equipment, miscellaneous hardware and adherence to safety procedures. The Contracting Officer or representative will also perform in-progress inspections as required and verify that the

Contractor in-progress inspections are performed in order to assure compliance with the specified installation criteria.

### 3.8.3 Final Inspection:

The Contractor shall conduct a final inspection that encompasses all phases of the installed project. This inspection shall be conducted to verify that all phases of the contract have been completed according to the contract requirements and proper installation practices have been followed. This inspection shall include a review of "red-lined" drawings, if applicable. The Contracting Officer or representative will participate in and witness the final inspection.

### 3.8.4 Corrective Action and Verification Inspection:

The Contractor shall correct any areas of noncompliance with requirements that are revealed by inspections. Following correction, a re-examination of previous noncompliance areas will be conducted at the discretion of the Contracting Officer or representative.

## 3.9 TESTING.

Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test. The tests shall be witnessed by Government Quality Assurance Personnel or the Contracting Officer's on site representative. Any discrepancies noted during testing shall be corrected, and those tests rerun, within 14 days. Contractual acceptance testing shall begin no later than two weeks prior to cutover.

### 3.9.1 Test Plan:

The test plan shall define milestones for each test, equipment, personnel, facilities, and supplies required. The test plan shall include the detailed test procedures to be completed, cross referenced to the specific contractual requirement. The plan shall also include steps for verification of station records and cable locations for all stations.

### 3.9.2 Test Reports:

A report detailing the results of all testing shall be delivered to the Government within seven days after completion of each phase of testing. The report shall contain sign-off/completion sheets for each test indicating test results, reason for failure, and signature blocks for both the Contractor and Government witness. Test sheets shall have the minimum:

- a. Name of person(s) conducting the test
- b. Name of person(s) witnessing the test
- c. Type of test being performed
- d. Name, model and serial number of the test equipment
- e. Calibration date of the test equipment

### 3.9.3 Test Equipment:

The Contractor shall supply and maintain the necessary test equipment to accomplish the following tests. All test equipment shall meet or exceed the standards, specifications and parameters as stated in the document. The Contractor shall maintain current calibration of all test equipment during the entire testing period. Calibration shall be accomplished according to the manufacturers specifications.

### 3.9.4 Tests.

#### 3.9.4.1 Basic Connection Tests:

Basic connection tests shall verify that the outlets are identified and connected in accordance with the drawings and specifications.

#### 3.9.4.2 Unshielded Twisted Pair (UTP) Tests:

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the telecommunications closet and at the outlet. Horizontal wiring shall be tested from and including the termination patch in the telecommunications closet to and including the modular jack in each room. Backbone (riser) cabling shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective telecommunications closets. These tests shall be completed and all errors corrected before any other tests are started.

#### 3.9.4.3 Category 5 Cable Tests:

The Contractor shall test all Category 5 cable runs in accordance with TIA/EIA TSB-67. Testing shall be done using the TSB-67 Basic Link test and channel tests procedures for Level II testing. Test equipment used shall meet the Level II accuracy

requirements of TSB-67. The tests shall be accomplished between each outlet drop and the associated telecommunications closet.

#### 3.9.4.4 Fiber Optic Cable Tests:

The Contractor shall test, verify, and document that the installed fiber optic cable meets all the essential cable parameters specified by EIA/TIA 455A, and the cable manufacturer.

END OF SECTION



SECTION 16770

PUBLIC ADDRESS SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Amplifier and control equipment.
- B. Input equipment.
- C. Speakers.
- D. Sound system cable.

1.2 RELATED SECTIONS

- A. Section 16010 - General Provisions - Electrical.
- B. Section 16111 - Conduit.
- C. Section 16123 - Building Wire and Cable.
- D. Section 16130 - Boxes.
- E. Section 16170 - Grounding and Bonding
- F. Section 16190 - Supporting Devices
- G. Section 16191 - Seismic Restraint Systems.
- H. Section 16195 - Electrical Identification.
- I. Section 16741 - Interior Telephone and Data, Pathways and Wiring.

1.3 CODES AND STANDARDS

- A. EIA 310C - Racks, Panels and Associated Equipment.
- B. NFPA 70 - National Electrical Code.

1.4 SYSTEM DESCRIPTION

- A. Public address system for voice.
- B. The public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and any ancillary

components required to meet the required system configuration and operation.

C. Input components:

1. Cassette tape player.
2. Compact disc player.
3. AM/FM tuner.
4. Microphone.

D. Features:

1. Interface to telephone system.
2. One-way paging by zone.
3. Emergency paging override.
4. Distribution of background music.

E. The system shall provide even sound distribution throughout the designated area, plus or minus 3 dB for the 1-octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) to any location in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Paschal (0.00002 Newtons per square meter).

1.5 SUBMITTALS: Submit under provisions of Sections in division 0 and 1.

- A. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.
- B. Data Sheets: Submit the manufacturers standard data sheets showing specified electrical characteristics and connection requirements for each different component.

- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, start-up and testing of the system.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Sections in division 0 and 1.
- B. Record actual locations of speakers, control equipment, outlets for input/output connectors and conductor types and routing.

#### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Sections in division 0 and 1.
- B. Operation Data: Include instructions for adjusting, operating, and extending the system.
- C. Maintenance Data: Include repair procedures spare parts documentation, submittal shop drawings and data sheets.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.
- C. Installer: Authorized installer of specified manufacturer with minimum three years documented experience.

#### 1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated. All products shall bear the UL Label.

PART 2 PRODUCTS

2.1 AMPLIFICATION AND CONTROL EQUIPMENT

A. Manufacturers:

1. Altec
2. Bogen
3. Electro Voice
4. Approved equal under provisions of Sections in division 0 and 1.

B. Mixer-Preamplifier

1. Mixer-preamplifier shall as a minimum conform to the following specifications:
  - a. Rated Output: 18 Db
  - b. Frequency Response: Plus or Minus 1 dB, 20 - 20,000 Hz
  - c. Distortion: Less than 0.2 percent, 20 - 20,000 Hz.
  - d. Signal to noise: Microphone - 60 dB, Aux - 70 dB.
  - e. Inputs: 5 independent balanced low-impedance, transformer-isolated.
  - f. Input Sensitivity: Microphone - 0.003 volts, Aux - 0.125 volts, Magnetic Cartridge - 0.0005 volts.
  - g. Input Channel Isolation: 80 dB minimum.
  - h. Tone Controls: Plus or Minus 10 dB range at 50 and 15,000 Hz.
  - i. Power Requirement: 120 Vac
  - j. Component Mounting: Rack or Wall

C. Power Amplifiers

1. Each power amplifiers shall as a minimum conform to the following specifications:
  - a. Rated Output: 75 watts RMS

- b. Frequency Response: Plus or Minus 2 dB, 60 - 13,000 Hz
- c. Distortion: Less than 2 percent at RPO, 600 - 13,000 Hz.
- d. Input Impedance: 50 k ohm unbalanced.
- e. Output Impedance: 83.3, 10.4, 8.0, and 4.0 ohms.
- f. Output Voltage: 70.7, 25, 22, and 15.5 volts.
- g. Power Requirement: 120 Vac
- h. Components Mounting: Rack or Wall.

D. Mixer Amplifier

- 1. Mixer amplifier shall as a minimum conform to the following specifications:
  - a. Rated Output: 60 watts RMS
  - b. Frequency Response: Plus or Minus 2 dB, 60 - 13,000 Hz
  - c. Distortion: Less than 1 percent at RPO, 60 - 13,000 Hz.
  - d. Inputs: 2 microphones (high impedance or low-impedance unbalanced 2 Aux. (high-impedance)
  - e. Output Impedance: Balanced 4, 8, and 16 ohms.
  - f. Output Voltage: 25 and 70 volts.
  - g. Power Requirement: 120 Vac
  - h. Components Mounting: Rack or wall.

E. Microphone Input Expander

- 1. Microphone input expander shall as a minimum conform to the following:
  - a. Rated Output: 0.25 volts into 10,000 ohms, 1.0 volts into 10,000 ohm.
  - b. Frequency Response: Plus or Minus 2 dB, 20 - 20,000 Hz

- c. Distortion: Less than 0.5 percent 20 - 20,000 Hz.
- d. Inputs: 4 transformer - coupled balanced 150 ohm.
- e. Input Sensitivity: 0.003 volts.
- f. Input Channel Isolation: 70 dB minimum
- g. Power Requirement: 28 Vac
- h. Components Mounting: Rack or Wall.

## 2.2 AM/FM TUNER

- A. Description: Tuner with 525 - 1605 kHz AM and 88 - 108 MHz FM tuning range.
- B. AM Performance:
  - 1. IF Rejection: Over 30 dB
  - 2. Selectivity: 40 dB
  - 3. Sensitivity: 2.0 microvolts.
  - 4. Fidelity: 100 - 4500 Hz, plus or minus 3 dB
  - 5. Capture Ratio: 1.0 dB
  - 6. Antenna Input: 75 ohms, unbalanced.
- C. FM Performance:
  - 1. IF Rejection: Over 50 dB
  - 2. Selectivity: 60 dB
  - 3. Sensitivity: 1.5 microvolts
  - 4. Fidelity: 50 - 15,000 Hz, plus or minus 3 dB.
  - 5. Antenna Input: 300 ohms, balanced.
  - 6. Capture Ratio: 1.0 dB.
- D. Input Voltage: 120 volts AC
- E. Component Mounting: Rack or Wall

## 2.3 TAPE PLAYER

- A. Description: Dual Cassette player with automatic reverse.
- B. Tape Speed (Play): 1-7/8 inch per second.
- C. Crosstalk: 45 dB minimum
- D. Frequency Response: 40 - 14000 Hz, plus or minus 3 dB
- E. Signal/Noise Ratio: Less than 60 dB.
- F. Speed Accuracy: +3, -2 percent.
- G. Distortion: 1.3 percent.
- H. Wow and Flutter: Less than 0.09 percent wrms.
- I. Play Head: Hard Parmalloy
- J. Fast Forward Time: 135 seconds maximum, with 60 minute cassette.
- K. Rewind Time: 90 seconds maximum, with 60 minute cassette.
- L. Input Power: 120 volts AC
- M. Component Mounting: Rack or Wall

## 2.4 COMPACT DISC PLAYER

- A. Description: Player shall have three beam laser pickup, dual Digital-to-Analog converters, random access and random mode programmable playback. Player shall have capability to play up to 6 disc automatically.
- B. Frequency: 10 - 20,000 Hz Plus or Minus 1 dB.
- C. Signal-to-Noise: Minimum of 100 db
- D. Dynamic Range: Minimum of 96 dB
- E. Total Harmonic Distortion: Maximum of 0.007% at 1 KHZ
- F. Channel Separation: Minimum 90 dB at 1 KHZ
- G. Quantization: Minimum of 16 Bits Linear per channel
- H. Conversion Rate: Minimum 4 x Oversampling

I. Disc Size: 5 inch and 3 inch

J. Component Mounting: Rack or Wall

## 2.5 MICROPHONE

A. Description: Floor stand type low impedance microphone with push-to-talk switch.

B. Element: Dynamic

C. Frequency Response: 50 - 16000 Hz

D. Impedance: 250 ohms (nominal)

E. Front-to-back Ratio: 20 dB

F. Directional Response: [Unidirectional]

## 2.6 CONE SPEAKERS

A. Description: Recessed ceiling mounted 8 inch coaxial speaker with integral crossover circuit.

B. Power Rating: 7 watts normal; 10 watts peak

C. Frequency Range: 30 - 20,000 Hz.

D. Sound Pressure Level: 95 dB at 3 feet (0.9 M) with 1 watt input.

E. Magnet: 10 ounces (283 g) low frequency unit; 3 ounces (85 g) high frequency unit. Material: Ceramic.

F. Voice Coil Impedance: 8 ohms.

G. Line matching Transformer Type: 25/70 volt line.

H. Capacity: 2 watts.

I. Primary Taps: 0.5, 1 and 2 watts.

J. Primary Impedance: 25 volts - 1250, 625 and 312 ohms; 70 volts- 10k, 5k and 2.5k ohms.

K. Insertion Loss: Less than 1 dB.

L. Dispersion: -3 dB at 90 degrees.



## 2.7 BAFFLES AND BACKBOXES

- A. Description: 12 inch (305 mm) round, painted steel, white finish with uniform perforations.
- B. Speaker Backbox: Round, recessed, steel, insulated with sound-deadening material.

## 2.8 SPEAKER SWITCHING PANEL

- A. Description: Zone control shall be provided for the paging function. The speaker switching panel shall contain position lever-type selector switches with mechanical detents and shall be rack-mounted. A designation strip shall be provided. Power supply shall be provided for priority relays and controls, rack-mounted and sized for a capacity equal to 200 percent of the as-built control system, and shall operate at 24 Vdc. Input and output shall be protected to permit Class 2 wiring in accordance with NFPA 70.

## 2.9 PRIORITY RELAYS AND CONTROLS

- A. Description: Priority relays and controls required to accomplish operations specified shall be provided. Relays shall be completely enclosed with a plastic dust cover for maximum protection against foreign matter, and shall be plug-in type. Relays shall be provided with a diode wired across the relay coil for transient suppression and shall be installed utilizing factory-prewired, rack-mounted receptacle strips. Coil shall be maximum 24 volts dc.

## 2.10 REMOTE SPEAKER VOLUME CONTROLS

- A. Description: Remote volume controls shall be an auto transformer type with detented 3 dB steps and an OFF position. The controls shall be wall-mounted in single-gang outlet boxes and furnished with engraved switching plates finished to match approved finish of electrical wall switches. Insertion loss of the controls shall not exceed 0.6 dB and the power-handling capacities of the control shall be 10 watts or as required. Low-voltage priority override relays shall be furnished as part of these controls with all wiring to the racks to allow override of the volume controls for priority announcements.

## 2.11 TELEPHONE INTERFACE

- A. Description: 600 ohm - auxiliary input.

## 2.12 EQUIPMENT RACK

- A. Description: Wall mounted equipment rack sized for the specified equipment and storage of microphones.
- B. Equipment Mounting Width: 19 inch (483 mm)
- C. Finish: Gray enamel finish.
- D. Include front and rear hinged and latched door.
- E. Include six receptacle multioutlet assembly inside rack.

## 2.13 AM/FM ANTENNA

- A. Description: Folded dipole AM/FM antenna and shall cover all frequency bands specified for the tuners. The antenna shall be supported at least 5 feet (1.5 m) clear above the roof by means of self-supported or guyed mast. The system shall be furnished complete with a transformer, insulators, crossover insulator, 75 ohm coaxial cable of proper length, lightning arresters, coupling transformer and divider network at the radio tuners. Attenuation of the coaxial cable span between the antenna and amplifier shall not exceed 2.5 dB at 108 MHz.
- B. Impedance: 300 ohm with matching transformer for 75 ohm coaxial cable.
- C. Construction: Use tubular metal elements.
- D. Wind Resistance: Withstand 100 mph wind.

## 2.14 MICROPHONE CORD

- A. Description: 20 AWG stranded copper conductor, 600 volt insulation, rated 60 degree C, two conductor shielded cable with rubber jacket.

## 2.15 INPUT CABLE

- A. Description: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket.

## 2.16 SPEAKER AND MICROPHONE WIRE AND CABLE

- A. Description: Cables shall be of the gauge required depending upon the cable run length. In no case shall any

cable be used which is smaller than 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than .009 inch. Cables shall be shielded with a 34-gauge tinned soft copper strand formed into a braid. Cables shall be jacketed with a PVC or Fluoropolymer compound. The jacket thickness shall be 0.0200 inch minimum.

#### 2.17 PLENUM CABLE FOR SPEAKER CIRCUITS

- A. Description: Cables shall be of the gauge required depending upon the cable run length. In no case shall any cable be used which is smaller than 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than .009 inch (.225 mm). Cables shall be shielded with a 34-gauge tinned soft copper strand formed into a braid. Cables shall be jacketed with a nonmetallic jacket suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts and plenums.

#### 2.18 MICROPHONE JACK

- A. Description: Each outlet for microphones shall consist of a standard outlet box, flush-mounted, and fitted with a three-pole, polarized, locking-type, female microphone jack and a corrosion resistant-steel device plate.

#### 2.19 MICROPHONE STAND

- A. Description: Each microphone shall have an associated stand which as a minimum shall consist of 35 inch (875 mm) [(850 mm) by 62 inch (1550 mm) chrome tube assembly with grip-action for locking control.

#### 2.20 POWER SURGE PROTECTION

- A. Description: Major components of the system such as power amplifier, mixer-preamplifiers, phonographs, and tuners, shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources.

#### 2.21 SIGNAL SURGE PROTECTION

- A. Description: Major components of the system shall have internal protection circuits which protects the component from mismatched loads, direct current, and shorted output lines.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's shop drawings and instructions.
- B. Mounting Heights: As indicated.
- C. See the architectural reflected ceiling plan for the exact location of devices mounted flush in or surface mounted on the ceiling.
- D. Speakers and backboxes in or on the ceiling shall be supported by the ceiling support system using support channels. The weight of the speaker or the backbox shall not be supported by the ceiling material. They shall be supported on the main runners only.
- E. A 90 degree angle bracket shall be installed on each end of each support channel with a self-tapping metal screw run through each bracket and the ceiling support tee to secure the bracket to the tee. If a support channel with a integral tee bar fastener is used, a self-tapping metal screw shall be run through each fastener and the ceiling support tee to secure it to the tee. In addition the speaker or backbox shall be supported from the structure above with one 12 gauge steel wire attached to the speaker or backbox at a point as near the center as possible.
- F. Speakers shall be secured to the baffles with a minimum of four screws of size required by the speaker manufacturer.
- G. Baffles shall be secured to the backboxes with a minimum of four screws of size required by the speaker manufacturer. Color of screw heads shall match the baffle color.
- H. Backboxes shall be secured to the support channels with a minimum of four screws of size required by the backbox manufacturer.
- I. Low voltage wiring may be run without conduit in accessible ceiling spaces not used as return air plenums. wiring shall be run in conduit or U.L. Listed plenum rated cable shall be used in all ceiling spaces used as return air plenums.
- J. Volume controls shall be installed in standard metal outlet boxes of size required by the device manufacturer. Gangable boxes shall not be used.

- K. Wiring shall be run in conduit in walls and any other inaccessible spaces; in wet and damp locations, in crawl spaces and where run exposed below 8 feet (2.4 m) above finished floor.
- L. Provide a bushing with an insulated throat on the ends of all conduits where they terminate in outlet or junction boxes, equipment cabinets, at backboards or stubbed into ceiling spaces, etc.
- M. Conduit types, fittings, routing and support shall be as specified in Section 16111.
- N. Cable run without conduit shall be routed parallel and at right angles with beams, walls, ceilings and other building lines. Cable shall be routed down corridors and branch off to rooms and/or devices.
- O. Main or trunk cables or groups of individual cables shall be supported by the cable supports provided on the corridor walls. Individual cables to a room or device may be supported by and attached to the ceiling support wire or the tee bar, wall, or other support using clips or fasteners designed for this purpose. Cables shall be supported at a maximum of 18 inches (450 mm) on center. Cables shall not be supported from ducts, pipes or conduits.
- P. Where cable is run without conduit, cable fittings shall be provided where cable enters cabinets, backboxes, etc. to secure the cable and provide strain relief. The fittings shall grip but not damage the cable insulation and shall be designed for this purpose.
- Q. In rooms or spaces without ceilings, cable may be run exposed on the structure without conduit above eight feet above the finished floor. Cable shall be supported at a maximum 18 inches (450 mm) on center with devices designed for this purpose secured to the walls or structure. Cable run below eight feet shall be in conduit.
- R. In rooms or areas with ceilings such as equipment and storage rooms where conduit, ducts, pipes, etc. are run exposed, cable may be run without conduit above eight feet above the finished floor. Cable shall be supported at a maximum of 18 inches (450 mm) on center with devices designed for this purpose secured to the walls or structure. Cable run below 8 feet shall be in conduit.

- S. Outlet and backboxes shall be supported as specified in Section 16130 unless otherwise specified.
- T. Wiring for microphone, grounding, line level, video, speaker and power cables shall be isolated from each other by physical isolation and metallical shielding.
- U. Splice cable only in accessible junction boxes or at terminal block units.
- V. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.
- W. Leave 18 inches (300 mm) excess cable at each termination at microphone, volume control, speaker, and other system outlet.
- X. Leave 6 feet (2 M) excess cable at each termination at system cabinet
- Y. Use armored cable for outside speaker circuits.
- Z. Use suitable cable fittings and connectors.
- AA. Install equipment racks in location shown; arrange to provide adequate ventilation and access. Racks shall be mounted side-by-side and bolted together. Items of the same function shall be grouped together, either vertically or side-by-side. Controls shall be symmetrically arranged at a height as shown. Audio input and interconnections shall be made with approved shielded cable and plug connectors; output connections may be screw terminal type. All connections to power supplies shall utilize standard male plug and female receptacle connectors with the female receptacle being the source side of the connection. Inputs, outputs, interconnections, test points, and relays shall be accessible at the rear of the equipment rack for maintenance and testing. Each item shall be removable from the rack without disturbing other items or connections. Empty space in equipment racks shall be covered by blank panels so that the entire front of the rack is occupied by panels.
- BB. Equipment cabinets shall be secured to walls with a minimum of four bolts. Where supported on concrete, masonry or block walls, anchors or other devices designed for this purpose shall be used. Where supported on gypboard and stud walls, vertical and horizontal bracing in the wall shall be provided to support the weight of the cabinet and

its contents and to receive the bolts or screws. Refer to Section 16190 and 16191.

- CC. Provide a laminated plastic sign attached to the front outside the cabinet with a minimum of two screws which reads "Public Address Equipment". The sign shall be black with 1/2" (13 mm) high white characters. Provide a separate sign of the same specification that indicates the power circuit number.
- DD. Ground and bond equipment and circuits in accordance with Section 16170.
- EE. The AM/FM antenna mast shall be separately grounded.
- FF. The system shall utilize a multiple-point signal grounding scheme where conductive path connections are required between each piece of equipment and the reference ground point. An isolated ground bar for power shall be provided for the connection of the main system components. The ground bar shall be connected to the main service ground utilizing a No. 6 conductor.

### 3.2 ACCEPTANCE TESTS

- A. After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The contractor shall notify the Contracting Officer 5 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or nondesignated units.

### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Start-up and test systems.
- B. Include making final wiring connections, inspection and adjusting of completed installation, and systems demonstration.
- C. Certify that installation is complete and performs according to specified requirements.

### 3.4 ADJUSTING

- A. Adjust transformer taps for appropriate sound level.
- B. Adjust devices and wall plates to be flush and level.

### 3.5 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01650.
- B. Conduct walking tour of Project. Briefly describe function, operation, and maintenance of each component.
- C. Use submitted operation and maintenance manual as reference during demonstration.

### 3.6 OWNER PERSONNEL TRAINING

- A. The Contractor shall conduct a training course for members of the operating and maintenance staff as designated by the Contracting Officer. The training course will be given at the installation during normal working hours and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance manuals, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to the start of the training course.
- B. Use submitted operation and maintenance manual as reference during training. Supplement with training materials as required.

END OF SECTION